CEREAL SCIENCE *today*

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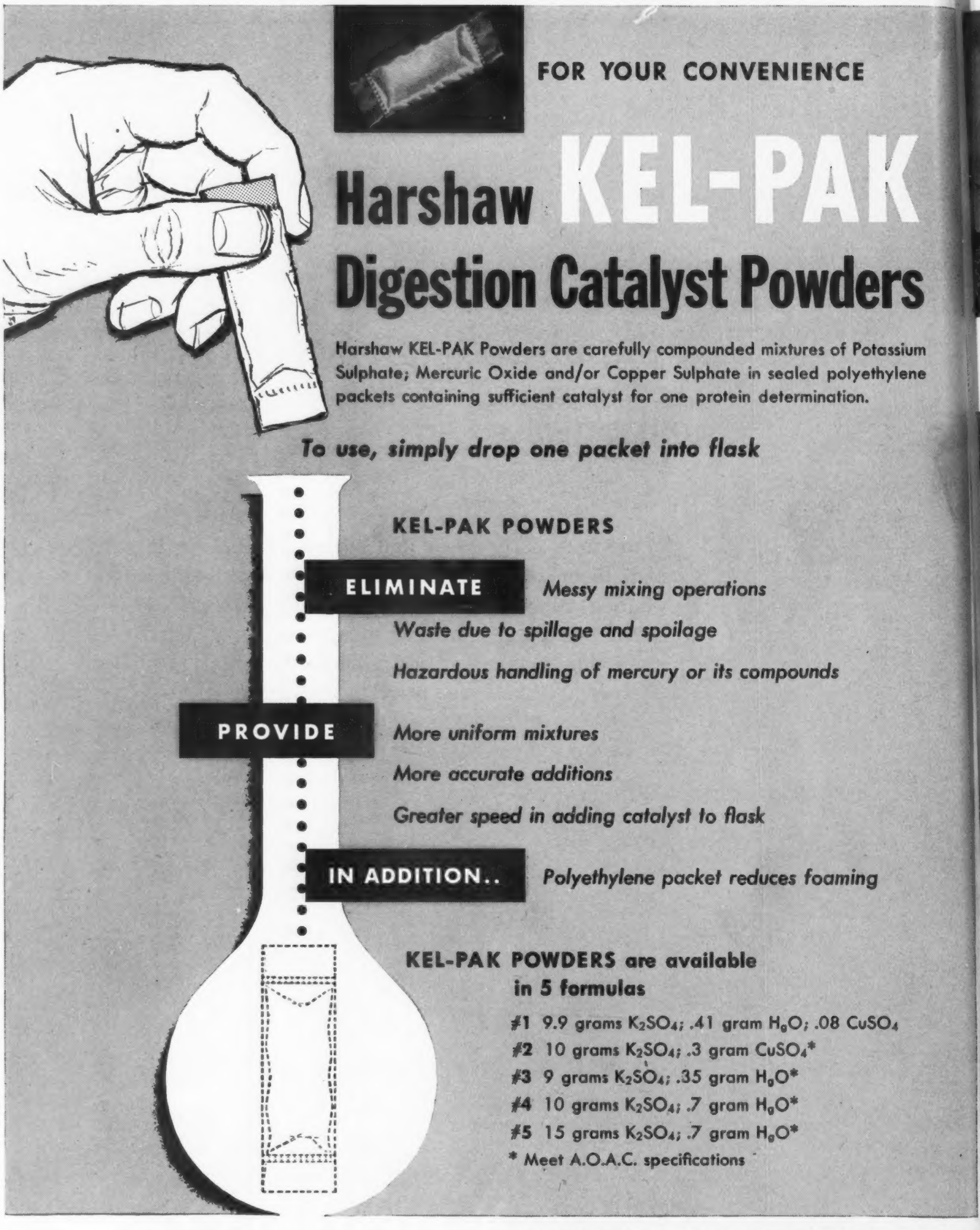
AN OFFICIAL PUBLICATION
OF THE
AMERICAN ASSOCIATION
OF CEREAL CHEMISTS

OF INTEREST THIS MONTH

NUTRITION FOR DEFENSE

HIGH-SUGAR YEAST DOUGHS

PROPERTIES OF 25 TO 33 YEAR OLD WHEAT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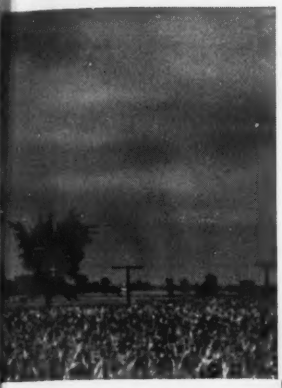

VOLUME 4 • NUMBER 6 • JULY 1959

CEREAL SCIENCE today

FEATURES

TECHNICAL SECTION

DEPARTMENTS

STAFF

COVER: A high-speed cookie cutter turning out cakes for Oreo Creme Sandwich, a Nabisco product. Heavy bronze plates or cylinders mark out the designs of crackers and cookies at the rate of nearly half a million an hour. Photo courtesy National Biscuit Co., New York.

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Editorial

A PLEDGE THAT the American Association of Cereal Chemists would seek ways of better serving the needs of chemists concerned with formulation, manufacture, and quality control of livestock feeds was reiterated by its president at the 44th Annual Meeting in Washington, D.C.

Once an adjunct to the flour milling industry, the feed business has undergone great change and expansion in recent years to become important in its own right. This change is largely the result of the application of new nutritional knowledge and the commercial availability of ingredients that not so long ago were laboratory curiosities.

Several organizations and publications have provided the media for communication between those concerned with technical developments in the feed field. We hope and expect that this will continue. We think that there is a field distinct from that of the nutritionist where the feed chemist has yet to reach his full potential value to the industry. This would include the writing of more meaningful specifications on ingredients, devising the soundest sampling methods, providing the fastest and most reliable quality control procedures, controlling and maintaining palatability, and improving the stability of important nutrients. These are areas where the AACC, with its local sections and national meetings, technical committees, and two publications, should be able to provide increasing value to the feed chemists.

The interest of the AACC in the feed chemists and their problems is not new, but we think it will be renewed with the recent appointment of Herbert C. Schaefer to the Board of Directors and the naming of Robert C. Wornick as Feed Technology Department Editor for CEREAL SCIENCE TODAY. Both of these men have made outstanding contributions to their field and enjoy the esteem of their fellow members in the AACC.

P.E.R.

THE PLACE OF CEREALS IN PLANNING

Nutrition for Defense

By Arnold E. Schaefer, Executive Director, Interdepartmental Committee on Nutrition for National Defense, National Institutes of Health, Bethesda, Maryland*

THE PURPOSE OF this scientific meeting was most ably described by your President, Clinton Brooke, in his Foreword to the program: "To aid in ascertaining the truth and to *expand* our vision of the world in which we live."

I appreciate and welcome this opportunity to tour the world verbally, discussing the topic "Nutrition for peace" and concluding with a discussion of plans for "Foods for shelters" or "Nutrition for defense."

Food is the basic need of people everywhere. The majority of the world's population, especially in the developing countries, are primarily concerned with *food*, *shelter*, and *health*. We often forget that in the not too distant past (20 to 30 years) our own country was afflicted with pellagra, rickets, goiter, anemia, and other nutritional diseases. Undernutrition and malnutrition are serious problems for many of these population groups.

It is most encouraging to note Congress' wording of the Mutual Security Act of 1958: "The Congress of the United States, recognizing that the diseases of mankind, because of their widespread prevalence, debilitating effects, and heavy toll in human life, constitute a major deterrent to the efforts of many peoples to develop their economic resources and productive capacities and to improve their living conditions . . ." Regardless of modern-day ideologies, world peace must have as its building foundation *food* and *health*.

Mission of the ICNND — Nutrition for Peace

The nutrition program to be described is a low-cost type of technical assistance which has been exceedingly well received by the developing countries.

The Interdepartmental Committee on Nutrition for National Defense (ICNND) was formally established in 1955 by a memorandum of agreement signed by the Secretaries of the Departments of Defense, State, Agriculture, Health, Education and Welfare, and the International Cooperation Administration. The Committee is composed of members from these agencies plus the Atomic Energy Commission. Frank B. Berry, Assistant Secretary of Defense (Health and Medical), serves as Chairman of the ICNND, and John B. Youmans, Technical Director, Research and Development Command, Surgeon General, U.S. Army, serves as Director of Field Surveys. They have contributed greatly toward ensuring the success and extension of this nutrition program to all parts of the globe.

The Secretariat for the Committee is located at the National Institutes of Health and is advised by a panel of consultants who are specialists in the fields of medicine, nutrition, biochemistry, food technology, and agriculture in various institutions throughout the United States. The purpose of the Committee is to deal with nutrition problems of technical, military, and economic importance in foreign countries in which the United States has a special interest.

Nutrition Survey Program

Early in 1956, as a part of the U.S. Mutual Assistance Program, the Committee launched a nutrition program for the purpose of assisting the developing countries in improving the health and welfare of their people. Since then, the Committee has sponsored nutrition surveys in Iran, Pakistan, Turkey, Libya, Korea, Spain, the Philippines, Ethiopia, Peru, and Alaska, with surveys scheduled for Ecuador, Vietnam, Laos, and Chile within the next year.

The nutrition projects are initiated only after formal requests are received from the participating Governments. Advance discussions are then held with the U.S. Mission staffs, the host countries' Ministries of Health, Education, Agriculture, and Defense, and cooperating United Nations organizations staffs. The initial phase of the nutrition project centers around the work of the nutrition survey team, composed of physicians (with interest in clinical nutrition), dentists, biochemists, dietary specialists, food technologists, and agricultural specialists. The success of these missions is due in great part to the high caliber and dedicated spirit of the nutrition team members who, in addition to serving in a technical scientific capacity, have extended good will, understanding, and assistance to our neighbors about the world. To date, over twenty universities and colleges throughout the United States and ten Government agencies and private foundations have contributed nearly eighty highly qualified specialists to carry out these missions.

The objectives of the nutrition surveys can best be summarized by three words: assess, assist, and learn. The assessment phase involves an evaluation of the nutritional status of the population and the capabilities and potential to improve the health of the people. In conjunction with the surveys, immediate assistance is given as follows: 1) by working side by

* Presented at the 44th annual meeting, Washington, D.C., May, 1959.

side with host country personnel, training them in nutrition evaluation techniques, emphasizing clinical and biochemical phases, dietary intake and food production studies; 2) by furnishing essential laboratory equipment and supplies for establishing a permanent medical, nutrition and food laboratory; 3) by defining the major nutrition problems and developing practical recommendations so that the host country can best utilize the resources within the country. The surveys afford an excellent opportunity for U.S. personnel to learn much from these countries regarding nutritional diseases, the foods and food habits, customs, and practices. Also, the clinical, biochemical, and dietary data obtained contribute to a better understanding of nutritional diseases.

Food and Nutrition Problems

The nutritional status of a population group is dependent upon environmental influences, such as geography, agriculture, transportation, education, economics, and social mores. In many parts of the world, at first sight one may be misled by the good physiques of the people; but it is not unusual to find that life expectancy is short and mortality among children extremely high. The weak or malnourished are not seen strolling down the roads and streets. Wherever malnutrition exists it is always the children who suffer most. Medicine in the developing countries has given little attention to the children.

Food Supply

Two main features characterize the world food situation during the past few years. On the one hand there has been an impressive increase in food production in most regions of the world. On the other hand, there is little indication that some of the longer-term, fundamental problems of world food and agriculture have come appreciably nearer to solution. For example, the food consumption per capita in many of the developing countries still remains below the pre-World War II level.

In considering the problem of narrowing the gap between requirements and supply, the rate of population growth is a factor of great importance. In a recent UN report it was estimated that, on the basis of the current annual population growth of 1¼% in the Far East and 2% increase in agricultural production, 25 years hence the supplies of cereals in the Far and Near East will have to be increased by about 80%.

For most of the developing countries the major source of calories is obtained from cereals; for example, in Turkey, Iran, and Pakistan the calories from cereal are approximately 70% of the total diet and for Korea, 81%, as compared to 21% in the United States (see Table I).

Although there are many similarities in food and nutrition problems within the countries surveyed, each country and areas within each country must be considered separately and practical recommendations implemented for the solution of the many individual problems.

Table I. Food Available for Consumption in Specified Countries, 1954-55[a]
(In calories per person per day)

	U.S. (1955)	*Spain*	*Libya (1955–56)*	*Turkey*	*Iran*	*Pakistan*	*Philippines*	*Korea*	*Peru (1955)*
All foods	3220	2500	2070	2678	1967	2124	2275	2058	2281
Cereals	687	1265	1220	1863	1358	1503	1328	1665	1003
Wheat	(570)	(1080)	(620)	(1294)	(1040)	(408)	(80)	(126)	(363)
Rice	(24)	(60)	....	(35)	(114)	(962)	(899)	(1110)	(159)
Corn	(66)	(75)	....	(283)	....	(55)	(349)	....	(236)
Barley	(5)	....	(530)	....	(179)	....	....	(384)	(206)
Pulses	52	110	40	94	67	104	35	28	167
Vegetables	186	220	30	110	19	51	159	113	455
Roots, tubers, starches	(110)	(160)	(15)	(64)	....	(21)	(143)	(80)	(441)
Fruits and nuts	162	95	410	122	106	57	96	41	79
Oils, oilseed, and fats	656	375	90	104	48	40	292	87	109
Sugar	496	110	135	89	147	158	147	14	246
Meats	432	145	55	132	92	32	105	54	130
Milk and cheese	446	125	80	145	121	146	47	3	61
Fish and eggs	103	30	10	19	9	33	66	53	31
Cereals as % of total	21	51	59	70	69	71	58	81	44
Animal foods as % of total	41	16	8	12	13	10	10	5	12

[a] ICNND, May 1958. Compiled from U. S. Department of Agriculture data.

Factors Influencing Nutrition

Agriculture. It is neither logical nor practical to compare agriculture in the developing countries to present-day practices in the United States. The hoe, the plow, the scythe, and the fork are still the main tools (and beasts of burden) for producing food for the great majority of the world's population. Changes in agricultural practices are slow and dependent upon education, demonstrations, economics, and transportation. Usually the type of agriculture practiced has been inherited, is dictated by climatic conditions, and is influenced by limited transportaton and social and religious customs.

Food Technology. At first impulse one may jump to the conclusion that in many areas of the world food technology is nonexistent. This is indeed misleading. Granted, it may not consist of the refined, scientific, mass-production type of equipment and processes we identify with our concept of food technology; but often food preservation techniques have been devised which are ingenious and make a great contribution to nutrition. A few examples are:

a) The dehydration of lemons (Iran) by merely burying the fruit in the desert sand. Surprisingly enough, this dried lemon still contains the vast majority of its vitamin C.

b) Preparation of "kimchi" by the Koreans, which is a salted, fermented acidic product made from large-rooted radishes and Chinese cabbage. This is akin to our sauerkraut and pickles. It represents an ingenious preserved food for supplying vegetables during the winter months and is an excellent source of vitamin C and vitamin A, which are well preserved.

c) "Miso" is a fermented soybean product used in Japan. This product can be fermented with a high riboflavin-producing yeast, which in essence results in a riboflavin-enriched food.

d) Rose cake (Turkey), which is prepared from dried rose hips compressed into a cake, is an excellent source of vitamin C.

e) Preservation of the high-vitamin C "salmonberry" in seal oil by the Alaskan Eskimo.

f) We are all familiar with dried and salted meats and storage of eggs in water glass (sodium silicate).

g) Fermented milks, such as yogurt, where refrigeration is impractical or unrealistic.

Food Habits and Taboos. The best means of appreciating the influence of food habits and customs on nutrition is to analyze closely our own prejudices. Each of us has many likes and dislikes based not on reason but on long-established custom, on what we were taught as children, and on observations in our local community. The true appreciation of the force and strength of custom and habit in the nutrition of people is essential to all welfare programs. We often criticize the diet and feeding habits of many of the developing countries as being extremely monotonous, where a food may be eaten three times a day, day in and day out. This may be monotonous by our interpretation; however, these people would and often do rebel against our dietary pattern.

Food habits in all countries do change; however, they change slowly, and it may require decades to make appreciable progress. One of the major deterrents to the potentially most fruitful nutritional reform programs is that the farmer changes his crops and practices with very great reluctance. Yes, even in an economy that does not have "price supports."

Transportation. In a large part of the world the lack of a transportation network is perhaps one of the greatest contributing factors in isolating areas and communities within a country, making the inhabitants dependent upon their own local resources.

Education. In many of the developing countries often less than 10% of the population is literate. In one African country, although one-fourth of the national budget is expended for education, only 3% of the school-age children are affected. This problem is also reflected in the shortage of technical and scientifically trained personnel within the country; for example, native physicians in both Libya and Ethiopia are fewer than the fingers on one hand. However, Ethiopia has, with the assistance of the International Cooperation Administration and the United Nations organizations, established a public health officers' training school which last year graduated 20 students. They are already contributing greatly to practical public health programs for Ethiopia.

Follow-Up Programs

Getting enough food and the right kind is a continuing problem; so the work of the survey team is merely the beginning. After the scientific data are analyzed, final recommendations are made to the country concerned; these recommendations center around better utilization of the resources already existing in the country, taking into account the local customs and habits of the people. The Committee has made available to the cooperating countries consultant service to assist them in continuing a nutrition improvement program. Institutes of nutrition have been established in Iran, Pakistan, and Turkey. They are all actively engaged in programs of correcting their principal nutrition problems.

Iran, with technical assistance from the International Cooperation Administration, has rehabilitated a cannery at Shahi and is now producing a stew-type ration which is used to supplement the Armed Forces ration in remote areas. This cannery, in addition to providing subsistence items for the Armed Forces, has created a ready market for both meat and vegetable products grown in this area. There has been a continuing interchange of ideas between the countries that have been studied, and this has been implemented by the formation of an International Committee on Nutrition, initially sponsored by Iran, Pakistan, Turkey, Iraq, the United States, and Great Britain. Nutrition conferences have been held in Iran in 1956 and Turkey in 1958, with one planned for Pakistan in 1959 and one in the United States in 1960.

The Committee advised the U. S. Military Mission, Taiwan, on the procurement of equipment and supplies necessary for the construction and operation of two rice premix plants in Taiwan for B-vitamin enrichment. These plants were completed in March 1958 and are being operated by personnel of the Republic of China.

Problems of Disaster Feeding

The office of Civil and Defense Mobilization created an Ad Hoc Advisory Group on Research and Development for Food for Shelters in October 1958. The responsibility of this Committee is as follows:

1. Advise on the food and food storage problems that require solution through research;
2. Recommend the priority for each;
3. Recommend the Government agency or private research institution which can best carry on the research;
4. Advise on funding and time required; and
5. Assist in coordinating studies on the over-all food and national shelter research program.

During the past few months this Committee has prepared tentative guidelines necessary for the formulation of a shelter feeding program. Some of these are: 1) minimal nutritional allowances; 2) packaging requirements; 3) list of foods having storage life at 68°F. for periods up to 10 years; 4) availability and use of agricultural surplus food.

In such a program where we are delving into the "unknown" as regards the severity of nuclear damage, repeated attacks, etc., numerous realistic assumptions must be made in order to propose, plan, and implement a disaster feeding program. Some of these assumptions are:

1. Shelters are essential for survival in a nuclear attack.
2. For most shelters the food products to be used must be of the ready-to-eat type, requiring merely the addition of cold or hot water.
3. Food to have a storage life of 5 to 10 years, at an average of 68°F.
4. Three types of shelters: (a) Those for the general public will be used by people of all ages. They are likely to be overcrowded and may be provided with few or no facilities for cooking. In such shelters food may have to be stored for several years. (b) Institutional shelters connected with schools, factories, etc., where cooking facilities *may* be available and a plan of rotation of stored food can be followed. (c) Private home shelters.

Minimal Nutritional Requirements

For planning purposes, it is essen-

tial to establish minimal nutritional guidelines. Such a proposed guideline has recently been adopted by the Committee.

In disaster feeding for periods of only a few weeks, drastic reductions in food intake are tolerated reasonably well except for infants, lactating women, and the injured. The most important nutrients are: first, water, then in the following order, calories, protein, thiamine, and vitamin C. During a 2- to 4-week period little attention need be paid to vitamins. This is particularly true if the calories that are available come largely from foods that furnish a variety of nutrients, such as cereals, potatoes, and milk.

Survival Ration

Of special interest to the American Association of Cereal Chemists has been a proposal that has received considerable attention; namely, the utilization of surplus agricultural commodities, especially cereal grains for the preparation of a cereal-type ration patterned somewhat after breakfast foods. The following proposal which I shall discuss was first brought to our attention by a group of Reserve Medical Service Corps Officers meeting at the U.S. Army Medical Research and Nutrition Laboratory in Denver in 1958.

This proposal was based on a plan for survival. In order to be economically feasible, such a survival ration can scarcely consist of the more desirable and usual food items presently consumed in the American dietary. Instead, it was proposed that for severe disaster conditions a simplified, inexpensive, nutritionally adequate, organoleptically stable survival ration be stockpiled in certain critical areas. Such a ration would be used only in an emergency when the food supplies would be inadequate to meet the disaster needs. The real food reserves of this country, of course, consist of large quantities of cereal grains, of which a large proportion is used to feed livestock and poultry. In case of a severe emergency, the livestock population of the United States would be competitors with man for the basic food supply.

While it is hoped that the extent of disaster involved in one or more nuclear attacks, should they occur, might not reduce our total food supply to critical levels, this possibility should be faced with reality and plans made accordingly. Such plans would involve careful control of the use of such critical grains as wheat, corn, and oats as well as our main legume crop, soybeans. It is proposed that the survival ration utilize surplus agricultural commodities consisting basically of cereals, soybeans, and dried milk. The advantages of such a ration are numerous: 1) it would be a prepared mixture requiring no preparation prior to consumption; 2) it is inexpensive; 3) it could be stockpiled; 4) it has a long storage life; 5) it could be periodically rotated into animal-feed channels. This latter point would greatly reduce the cost of any material that was stockpiled.

Such a product avoids the need for special feeding equipment or, in fact, any equipment. It could be consumed "as-is" or used as a gruel or combined as a supplement to other available foods. It would eliminate the sanitary hazards associated with trying to cook foods without adequate facilities and trained personnel. It is estimated that a pound of such a ration could be supplied at a basic cost of approximately 9 cents, with each pound furnishing approximately 1,600 calories.

Advance educational efforts would be required to use such a food satisfactorily. Its mere existence should relieve much anxiety of the public. Without the foresight to predict how rapidly the food industry could recover after a nuclear attack, it appears to me that the only realistic planning approach must consider the possible need for such a survival ration even after the immediate disaster condition is over; whether this be for a period of one week or six to eight months. Thus, consideration should be given to the possibility of utilizing any and all food processing plants throughout the country, whether they be the conventional human-food processing industries or whether they be primarily concerned with animal-feed manufacturing.

Surplus Agricultural Commodities

As an example of the tremendous food reserve available in the United States as of January 28, 1959, estimated total stocks of the Commodity Credit Corporation are as follows:

Corn	1.1 billion bu.
Wheat	0.7 billion bu.
Rice	0.4 billion lb.
Dried milk	51 million lb.
Cheese	4 million lb.
Butter	16 million lb.

These are only a few of the representative products available and, of course, represent a comparatively small proportion of the total production of the United States.

Summary

The nutrition surveys of the ICNND are an integral part of the foreign aid under the U.S. Mutual Assistance Program. We like to think of this program as a people-to-people approach to mutual assistance and security. The Committee is indebted to the International Security Affairs of the Department of Defense who, having recognized that food is a basic need of not only the Armed Forces but of people everywhere, have included support of this program in their Mutual Assistance budget.

The Committee has been most gratified by the friendliness shown to our teams by our neighbors around the world and we are happy to be able to contribute in some measure to their health and well-being.

Disaster feeding is a problem of immediate concern and warrants the attention of all food processors in the development of a low-cost, stable, nutritious emergency food for our entire population.

Important Notice

The editorial and business office of the AACC including its two publications, CEREAL CHEMISTRY and CEREAL SCIENCE TODAY, has moved to new quarters. Correspondence should be addressed to:

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A NUTRITION AUTHORITY TELLS OF

Current Trends in Lipid and Protein Nutrition Research

By C. G. King, Executive Director, The Nutrition Foundation, Inc.*

A CRITICAL VIEW of nutrition research in the present national and world scene will at once focus attention upon the lipids and proteins. This intense interest in fats and proteins is dominant whether one is thinking in terms of public health, industrial practice, or basic research.

Human Health

In relation to public health, the questions in this country, in Canada, and in Western Europe are most sharply concerned with excessive caloric intake and the closely related need for more information about fats. Proteins would be second, and well ahead of the other three classes of nutrients. For about one-half of the world's population, however, where technologic and economic progress has been less rapid, the center of interest is on the problem of securing an adequate intake of good-quality protein. An adequate supply of calories from any source would be their second problem, so they, too, have an intense interest in their basic supply of carbohydrates and fats.

Most authorities in public health and in nutrition agree that in the United States, Canada, Western Europe, and in many other local sections over the world where economic conditions are favorable, the problems associated with lipid metabolism represent the most important area of public health research. This is especially true for the upper age brackets because of the poorly identified relationships to seven of the ten leading causes of death and crippling diseases.

When one looks at the situation in areas where technical advances are more retarded, however, as in Central and South America, Africa, the Near East, India, and Southeast Asia, the contrast with conditions here could scarcely be sharper. In these areas of severe protein deficiency, the critical age range where malnutrition does its greatest damage is between weaning time and entering school — or roughly, 6 months to 5 years of age. The death rate for this age group ranges up to 10 or 20 times the rate here and in Western Europe.

Industrial Practices

The health problems indicated briefly in the above paragraphs cannot escape having a strong impact on industry and on the eating habits of the public. I believe this audience of scientists guiding the present and future practices of industry will have an important part in solving many of the problems related both to fats and to proteins. One need only mention, for example, the obvious importance of shaping food and feed practices to accomplish the greatest possible economic and health benefits in the use of salad oils, shortening, table spreads, oil seed press cake, and cereals. The trends will include the selection of raw materials, types of processing, and changes in the composition of finished products. Changes with respect to protein will be no less striking.

For the first time in history, about one-half of the world has reached an economic and technical position where it is possible and practical to furnish completely adequate diets for the resident populations. Even in these countries, new raw materials, new markets, and new products continue to present opportunities that affect almost every segment of the food industry. To reach satisfactory levels of nutrition for the rest of the world, still greater changes are obviously at our doorstep.

Basic Research

Both the medical profession and the scientists who guide industrial practices are under intense obligation and increasing demands on the part of the public to find answers to such problems as indicated above. Unfortunately, the scientific world is not yet in a position to furnish answers to many of the most serious problems, because of a lack of basic information. Today, there are strong indications that control of avoidable disturbances in fat metabolism in the human body, if understood more clearly, would enable the public to postpone or decrease the incidence of coronary heart disease, cerebral strokes, diabetes, fatty livers, and many other related conditions. It is encouraging to note the intensive study of these problems in our leading university research laboratories, with extensive cooperation from industry. We can feel confident that with each year's advance in basic discoveries of this nature, industry and the medical profession will have sharpened tools with which to attack the problems now confronting us. Certainly in the field of lipid research, the intensity of interest and the rate of progress are most encouraging. The advances in analytical techniques, for example, have been about as exciting as one could ask for, and certainly have reached beyond what anyone could have envisioned only a few years ago.

With respect to meeting the problem of protein malnutrition, the background of basic research has been relatively more adequate. The discoveries of investigators such as W. C. Rose in establishing the human

* Presented at the 44th annual meeting, Washington, D.C., May 4, 1959.

requirement for specific amino acids, the work of C. A. Elvehjem and his associates in identifying the importance of amino acid balances, the advances in biochemical genetics by G. W. Beadle, and the development of sensitive, accurate methods of amino acid analysis have furnished a background for effective national and world-wide attacks on the most difficult problems.

Changing Attitudes About the Use of Lipids

For many decades of nutrition research on lipids, primary interest centered on the value of their caloric or energy content. We still need to keep a balanced viewpoint in regard to the many advantages of lipids in practical dietaries, including their value from a physiologic viewpoint. They also meet practical needs for efficient low-cost and attractive foods. We also need to remember the early investigations of R. W. Swift and his associates at Pennsylvania State University, in which the optimum range of fat intake was somewhere above 30% of total calories — with no indication, at least in rats, that there was any hazard in going as high as 50% of total calories.

The next chapter in basic research on the role of lipids in nutrition centers on the fat-soluble vitamins, A, D, E, and K. At present, research is very active with respect to the roles of vitamins E and K. So little is known concerning their value in human nutrition that standard practices in food usage have scarcely been possible. The interplay of vitamin E with the mineral element, selenium, has given many surprising results within the past two years. As a result of the partial clarification of this unique situation and the discovery by Paul Gyorgy of the sensitivity of red blood cells to vitamin E deficiency, this vitamin now has a more substantial place in human physiology. M. K. Horwitt has recently reported its quantitative relationship, in being required by human adults in direct proportion to the intake of unsaturated fatty acids.

Vitamin K has come into active consideration in studies of heart disease and related problems where blood clots are important. Along with the fatty acids, it functions in the reversible balance against heparin as furnished in the liver and dicumarol products used in medical practice.

The third great advance in understanding the nutritive role of the lipids resulted from the discovery of G. O. Burr and his associates that individual fatty acids (linoleic, linolenic, and arachidonic) had a unique nutritive value and might be regarded as essential nutrients. More recent work has indicated that linoleic acid has a more specific role than either linolenic or arachidonic.

When the individual fatty acids and groups of fatty acids came under intensive study with respect to cholesterol regulation, a new and very complex situation was at hand. This fourth area is now being studied more intensively than any other aspect of human and animal nutrition. The nutritional aspects of lipid metabolism and the related injuries to health are far more complex and require more time for clarification than is generally recognized. Restraint and conservative policies are called for especially in dealing with the public.

For example, a great number of factors besides fatty acids can influence the concentration of cholesterol in the blood. Secondly, there is still great uncertainty among the most competent research scientists, whether moderate changes in serum cholesterol concentration are actually related to major risks in human health, such as heart disease, hardening of the arteries, and cerebral "strokes." Thirdly, an extensive number of nonnutritional factors appear to have a close bearing upon atherosclerosis, including genetic background, physical activity, smoking, infections, chemical exposures, and emotional stress. Among the nutrient deficiencies or imbalances that can give rise to atherosclerosis in experimental animals are the following: deficiency of choline, of methionine, of protein, of vitamin B_6 or of magnesium; an excess of bile acids, or of salt, or of nitrogen bases such as the purines and pyrimidines. The additive effect of applying two or more of these stresses simultaneously can be very striking, also.

The public has been exposed to a rapid succession of premature conclusions about heart disease and atherosclerosis. We had the highly publicized campaign against the use of foods that contained cholesterol. In this instance there was a failure to appreciate the normal activity of the body in forming and regulating cholesterol in a quantitative range well above the amount furnished in the protein foods. Then a wave of fear was spread about the fat content of our diets. This approach has been distorted often, too, in the failure to differentiate between an excessive total caloric intake and the consumption of specific fats. More research is needed to establish the optimum intake and the ideal composition of edible fats, but there is general recognition now that both unsaturated and saturated fats have a respected and valuable place in our dietaries.

One can already see examples of the agricultural and industrial impact of this trend, in the rise of safflower oil production from 20 million pounds in 1951 to 146 million pounds in 1958, and in the increased attention to conserving the linoleic acid content of edible oils from soybean, corn, cottonseed, peanuts, sunflower, and sesame. These edible oils have an obvious advantage over some of the traditional choice salad oils such as olive, palm, and coconut oil. The latter have very little linoleic acid. The trend in current research also lends a favorable aspect to poultry fat and the body fat of edible fish. It is a bit exciting to note that certain fish oils exert a favorable effect on human serum cholesterol values, despite a very low content of linoleic or linolenic acid. Whether this is significant in terms of atherosclerosis has not been established.

Proteins

A crucial problem has always faced mankind when a high population density puts pressure on the land and water resources to furnish an adequate supply of high-quality protein foods within the economic reach of the entire population. For the first time in human history, this country and others that are in a comparable economic and technologic position have reached a point where they can meet the problem reasonably well. However, when we move into the less-favored areas of the world which now contain roughly one-half of the world's population, we find that conditions are by no means satisfactory. The problem becomes particularly acute in the immediate months and years after the child is weaned. During these preschool years there is a very high demand for good-quality

protein to support growth and to protect the individual against infections such as tuberculosis, pneumonia, and diarrhea. Unfortunately, our vital statistics in dealing with international health problems of this kind have failed to recognize the fundamental causes of illness and death during these early critical years.

Large sections of Central and South America, Africa, the Near East, India, and Southeast Asia serve to illustrate the problem. To accomplish immediate relief from hunger there is a tendency to feed infants and small children (and to a lesser extent adults) materials that are lowest in cost and most convenient. Hence, products are used that are high in starch and sugars, but may be tragically deficient in other nutrients (proteins, minerals, vitamins, and fats). Most characteristic and most damaging of the resulting deficiencies is the failure to furnish enough good-quality protein. Furthermore, the good-quality protein foods are usually generous sources of the other essential nutrients. Next to the animal protein foods in their provision of essential nutrients are the legumes, high-protein cereals, green leafy foods, and other plant sources of protein that can substitute, though less reliably, for the animal types of protein. Specific details of the pattern change from country to country, but the essential problem is remarkably constant. For example, in Mexico, Central and South America and in the Caribbean area, the low-cost energy sources are likely to be corn, manioc, rice, crude sugar, and plantain. None of these, however, will permit an infant to survive and grow normally without additional protein. Hence one finds that the next type of food selected to achieve survival of the population is usually a favorite bean that has been grown locally for centuries. In many sections of southeast Europe, Africa, the Near East, India, and southeast Asia there is a similar excessive dependence on corn, rice, millet, and crude sugar without an adequate intake of good-quality protein. With assistance in material ways and encouragement by the educational efforts of the more technologically advanced countries, there is a growing recognition of the nature of the problem in each part of the world, but the development of resources with which to meet the fundamental needs will require a long time.

Progress in Solving Problems

Private industry is making a major contribution toward actual solution of the problem in many areas, through increased production of milk, meat, poultry, fish, and other high-quality foods. In Brazil, for example, one single company has been adding a new milk plant to its production line every two years. Many private foundations (e.g., the Rockefeller, Ford, and Kellogg foundations, the Williams-Waterman Fund), along with the international agencies (FAO, WHO, and UNICEF) and national governments, are attacking the problems in their respective areas of operation.

The distribution of foods from areas of surplus in other countries is making worthy and really great contributions in immediate service, especially by salvaging the health of millions of children, but the problem cannot be solved permanently when there is too much reliance on shipments of this nature. Basically there must be greater efficiency in the production and utilization of foods within each economic and geographic unit.

Among the specific changes that now receive a great deal of attention are the plans for making greater use of legume crops such as beans, peas, and grams, and the use of oil-bearing seeds of any type that will furnish a press cake or extraction residue that is high in protein of good supplementary value. These products can be used directly or in mixtures with other low-cost foods to reach a known and necessary balance of amino acids. In addition to the above legumes, cottonseed flour, peanut flour, sesame flour, coconut meal, sunflower meal, and soybean products offer considerable promise. Special research on these products is supported by the Rockefeller Foundation and is being coordinated on a world-wide basis by a committee (chairman, W. H. Sebrell, Jr.) of the Food and Nutrition Board of the National Research Council.

One of the projects now under the direction of Nevin S. Scrimshaw at INCAP in Guatemala City provides for field trials on a coarse cereal flour that has an acceptable flavor, high nutritive value, and other essential characteristics. It is made from equal parts of corn, sorghum grain, and cottonseed flour, supplemented by a small amount of yeast and either a leaf meal or synthetic vitamin A. In the Philippines there is an interest in the possible utilization of coconut press cake. In Africa and in India there has been relatively more interest in peanut flour, even though the protein quality in this instance is not high. They are getting good results also from feeding a local legume, called Bengal gram, as a supplement to rice.

Better Outlook in Lysine

The prospect of using synthetic amino acids to accomplish a more balanced amino acid content in low-cost foods has received a substantial boost by the recently announced low price for synthetic lysine. A single-step fermentation process of manufacture has made it possible for Merck & Company to announce a price quotation of $6.00 per pound in contrast to $12.00 quoted only four years ago. This product bids fair to complement the further production of synthetic methionine which is already used commonly in animal feeds. In view of the fact that lysine and methionine are especially effective in raising the over-all nutritive value of proteins furnished by many low-cost cereal foods, the outlook for developments in this field is considerably brightened. The situation is somewhat anomalous, however, because in the sections of the world where the economy might support the use of these products, there is already available an adequate supply of animal protein foods. The areas where protein deficiencies are severe are also the areas where economic factors are least favorable to meeting the present cost of synthetic products. The primary questions to be considered are: first, will the promotion of these products be based on fairness to the public with respect to actual need; second, where are the areas that can be served best; and third, how rapidly can the use of synthetic products prove their value on a combined health and economic basis?

Where We Stand

In conclusion, we are passing with surprising rapidity from the age-old situation of struggling for an ade-

quate food supply, to one of world-wide transition, when about half of the human population has available for its use an adequate supply of food of known nutritive quality to meet all of its needs and within the reach of all economic classes. Currently, for them, the surplus is embarrassingly large because of inadequate administrative policies. This abundance is something for which we should be extremely grateful. Thus far, however, we seem to fall badly short of our potential goal because of faulty education of the public and inadequate management of our resources. This is especially true in our attempts to adjust the flow and use of foods on a sound international basis.

Each year, the science of nutrition is being geared more closely to agriculture, to food technology, and to the most urgent needs in protecting human health. The outlook is encouraging, but certainly it is complex and exciting in terms of the human service and economic values that are within our reach.

Packaging awards. Among the 100 best cartons of 1958, nineteen food packages won awards in the competition sponsored by the Folding Paper Box Association of America. The winners were chosen by a jury of 21 printing and packaging experts during a week of judging, and are being shown in 20 major cities this spring. Some of the foods judged superior in packaging were: Prime Dog Food (General Foods Corp.), Merit Award; Wheat Chex (Ralston Purina Co.), First Award; Pepperidge Farm Frozen Pastry (Pepperidge Farm, Inc.), First; School House Cookies (George A. Krug Baking Co.), First; Hi-Pro (General Mills, Inc.), First; Betty Crocker Pudding Cake Mix and Chocolate Cake Roll (General Mills, Inc.), both Merit; and Farm House Frozen Pies (Connecticut Pie Baking Co.), Merit. Cartons were judged in four major categories—printing, construction, potential new volume use, and general merchandising quality.

HOW SUGAR FUNCTIONS IN HIGH-SUGAR YEAST DOUGHS[1]

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Sweet yeast-raised baked foods—coffee cakes, rolls, Danish pastry — differ widely in physical characteristics. While it is impossible to generalize on the best procedure for preparing the doughs, the high percentages of sugar used have important effects on the fermentation of yeast and on the properties of the dough, and these are reflected in the volume and the eating and keeping qualities of the finished product.

The percentage of sugar in sweet yeast-raised doughs is seldom less than 20%, based on the flour, and is often 25%. The sugar dissolves in the water phase of the dough, and thus produces a solution of approximately 30% concentration, compared with 10% in bread doughs. Bakers making high-sugar doughs must give recognition to the effect of this higher concentration on the functional properties of sugar in such doughs as they set up conditions to make baked goods of maximum quality. These include the rate of inversion of sugar, the rate of fermentation, the effect on mixing of doughs, and retention of sugar and moisture.

Rate of Inversion

A chemical determination of the sugars in a yeast dough made with 20% sucrose and 6% yeast showed that the sugar was completely inverted into equal parts of dextrose and levulose at the end of the mixing period. Indeed, the inversion proceeded so rapidly that in 2 minutes 90% of the sugar was no longer present as sucrose. This is an important point, because many bakers are under the impression that much of the sugar remains unchanged during fermentation and that its presence accounts for the sweetness of the finished product. The fact is the sweetness of high-sugar yeast-raised products is attributable to the presence of levulose, which is generally rated at 175 in sweetness compared to sugar of 100 and dextrose of 70. Furthermore, levulose has other important properties which contribute to the effectiveness of high percentages of sugar in sweet baked products.

Rate of Fermentation

The rate of fermentation of sucrose by yeast is influenced by the concentration of the sugar in the liquid phase of the dough. The percentages of sugar normally used in the production of white pan bread have little effect on the time required for the dough to rise. In bread production the fermentation time of the dough is adjusted by the amount of yeast in the formula to fit the bakery equipment and shop schedule. In doughs containing high percentages of sugar, as in sweet yeast-raised doughs, the effect of the higher concentration of sugar in the liquid phase becomes an important factor in the selection of the proper amount of yeast required to maintain an actively fermenting dough, and the percentage used must be greatly increased. Here again shop conditions, such as the capacity of the space in which the dough must rise, determine the percentage of yeast.

The effect of various amounts of sugar in a dough fermented under carefully controlled conditions of time and temperature emphasize the necessity of increasing yeast in the high-sugar doughs, as is shown in Table I. Doughs were run at 86°F. in a Blish-Sandstedt pressuremeter.

TABLE I
EFFECT OF SUCROSE ON RATE OF PRODUCTION OF CARBON DIOXIDE
(Millimeters of mercury pressure)

Time (Minimum)	Percentage of Sucrose[a] 3	10	20
hours	*mm*	*mm*	*mm*
1	118	104	63
2	138	141	104
3	122	139	118
4	128	138	123
5	101	138	121
6	73	115	114

[a] Based on flour.

Salt is also an important factor in fermentation. Bakers are quite aware that the rate of fermentation can be controlled by the amount of salt in the formula. In this respect sugar and salt have a similar effect which differs in magnitude per unit weight because of the difference in osmotic pressure they exert on the yeast cell. This action of salt makes it desirable to reduce the percentage in a high-sugar dough in order to keep to a minimum the amount of yeast necessary to maintain a rate of fermentation which will give the best results in terms of economy of shop operation and quality of the finished product.

Another factor in rate of gas production in high-sugar doughs is the amount of water used in preparing the doughs. The smaller the amount of water, the higher the concentration of the sugar solution in the dough, and the slower the fermentation.

High concentration of sugar in sweet doughs places a demand on the fermenting power of yeast which, for the most part, has been overcome by modern yeast technology.

The rate of fermentation of a high-sugar dough can be controlled by the baker by means of an intelligent balancing of yeast and salt.

Effect on Physical Properties of the Doughs

Absorption. Sugar, in the amounts used in bread, has little effect on the absorption of the dough, but it does in high-sugar doughs. However, the absorption can be maintained at the same percentage as in the lower-sugar doughs, provided the dough is mixed considerably longer. This can be shown graphically by recording the consistency and rate of dough development in the farinograph. Table II shows clearly the increased mixing time required

[1] Condensation of a paper presented at the 40th annual meeting, St. Louis, Mo., May 1955.

o develop a dough to a standard consistency as the percentage of sugar is increased.

TABLE II
EFFECT OF SUGAR ON DOUGH-DEVELOPMENT TIME

SUGAR	ABSORPTION	TIME TO MAXIMUM DEVELOPMENT
%	%	*minutes*
0	63.4	5.5
3	63.4	5.5
10	62.7	6.0
20	62.7	7.0

The effect of absorption on the consistency of a dough when the sugar used is kept constant at 20% is shown in Table III. In this the consistency is recorded as Brabender units (B.u.), which increase as the dough becomes stiffer.

TABLE III
EFFECT OF ABSORPTION ON A DOUGH CONTAINING 20% SUGAR

ABSORPTION	DEVELOPMENT TIME	CONSISTENCY
%	*mm*	*Bu*
62.0	7.5	540
60.0	6.5	590
58.0	6.0	650
56.0	5.5	720
54.0	5.0	800

A reduction in the amount of water used in a high-sugar dough decreases the time required to develop the dough to the maximum and increases the consistency. Too often bakers reduce the amount of water in order to maintain a short mixing time, a practice which results not only in reduced yield but in sweet goods of reduced volume, drier crumb, and poorer keeping quality, because the dough is not properly developed.

Mixing Requirements

The absorption and mixing time of a dough are interrelated. As the absorption is increased, the time required for the dough to develop is also increased. This relationship can be easily followed by the use of the farinograph. Bakers are quite aware of it in their dough-mixing operations. Sugar, as is noted above, has little effect on absorption if the dough is given the longer mixing required to develop the dough.

The effect of increasing percentages of sugar on absorption and rate of dough development is shown in Table IV.

TABLE IV
EFFECT OF SUCROSE ON FLOUR-WATER FARINOGRAMS

SUGAR	ABSORPTION	INITIAL PHASE (I)[a]	M[b]	R	D[c]
%	%	*minutes*	*minutes*	*minutes*	*Bu*
0	63.4	1.5	5.5	9.5	90
3	63.4	2.0	5.5	8.0	100
10	62.7	2.5	6.0	7.0	90
20	62.7	5.0	7.0	7.0	70

[a] I = time to reach a predetermined consistency.
[b] M = time required for dough to reach maximum development.
[c] D = decrease in consistency at end of fixed time.

Thus, the amount of water that a high-sugar dough can absorb is not significantly less than one with low sugar, but the rate of dough development as indicated by the initial phase (I) of the farinograph curve is greatly increased.

Doughs made in a laboratory mixer show by subjective tests the effect of increasing amounts of sugar at constant absorption on the rate of development. This is reflected in the time required for the dough to clear the sides and bottom of the mixing bowl, described by bakers as the "clean-up" time (see Table V).

TABLE V
EFFECT OF SUGAR ON "CLEAN-UP" TIME OF DOUGH

SUGAR	ABSORPTION	"CLEAN-UP" TIME
%	%	*minutes*
3	60	0.75
10	60	1.0
20	60	5.0
20	54	0.50

The importance of this in commercial sweet dough production is that in order to incorporate the maximum amounts of water, a sweet dough must be given a long mixing time at high speed.

Farinograph studies of the effect of sugar in doughs containing all the components of a sweet dough (milk, eggs, shortening, etc.) reflect a similar increase in dough development time when the absorption is maintained at the high sugar levels (Table VI).

TABLE VI
EFFECT OF VARYING PERCENTAGES OF SUCROSE ON SWEET DOUGH FARINOGRAMS

SUGAR	ABSORPTION	INITIAL PHASE(I)	MAXIMUM DEVELOPMENT(M)
%	%	*minutes*	*minutes*
3	63.0	12	15
10	63.0	13	16
20	63.0	19	22

Sugar dissolved in water before it is added to the dough functions in the same manner as when added in dry form. Liquid sugar can thus be used in sweet doughs with equally satisfactory results provided, of course, proper adjustment is made for the water and sugar solids contained in it.

Sugar and Moisture Retention

Invert syrup is hygroscopic — that is, it absorbs moisture from the air. This property is largely a function of levulose — not dextrose — and it has many commercial applications. As a simple illustration, the hygroscopic properties of moist syrup help to keep soft certain types of cookies.

The moisture-retention capacity of yeast-raised products depends on the percentage of levulose present in them. Breads made with low sugar content contain little levulose, and hence tend to dry out rapidly when exposed to air of low humidity. When bread made with 3% sugar was compared with a sweet dough of 20% sugar, made into the form of a bread loaf, it was found that under the same conditions of temperature and humidity, slices of bread lost approximately 36% of the required moisture, whereas the sweet-dough bread lost virtually no moisture. By subjective tests the sweet dough was soft and moist whereas the low-sugar bread was hard and dry. Since

sugar is the only source of levulose in yeast-raised products, no other sweetener will give similar results. This emphasizes the importance of using sufficient amounts of sugar to take advantage of the moisture-retention properties of the levulose.

Summary

1. Sucrose is completely inverted in high-sugar doughs at the end of the dough-mixing period.

2. High sugar concentrations retard greatly the rate of fermentation. This can be compensated for by an increase in percentage of yeast and reduction of salt.

3. High percentages of sugar increase the time required to mix and develop the dough.

4. A tendency to reduce absorption of the doughs to reduce mixing time should be avoided.

5. Baked goods made with high percentages of sugar retain moisture and stay fresh because of the moisture-absorbing properties of levulose.

PROPERTIES OF FRYING FAT RELATED TO FAT ABSORPTION IN DOUGHNUT FRYING

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EATING QUALITY OF doughnuts is closely related to the amount of fat they absorb during frying. The fat absorbed can be objectively measured, and therefore it plays an important role in the quality control of doughnuts. The amount of fat absorbed is known to be governed by ingredient composition, by the processing of the dough, and by time and temperature of frying, but the nature and state of deterioration of the frying fat is a variable about whose role there has been some equivocation.

Lantz and Carlin (8) and Arenson and Heyl (1) have indicated that the types of fat and their source are not prime factors in fat absorption. Arenson, moreover, found no correlation between fat absorption and free fatty acids to a level of 0.6%. Fisher (5) did find a positive relation with free fatty acid (FFA) content in the range of 0.03 to 0.4% using hydrogenated vegetable fat. Goodman and Block (6) demonstrated that the relationship between free fatty acid and fat absorption is not a simple one, by showing that fats heated in air to a high acidity and diluted with fresh fat caused more fat to be absorbed than fats that had reached an equivalent acidity by normal frying procedure. They showed that, under these conditions, iodine number was more closely correlated with fat absorption than was the FFA content. This conflicting evidence for the relationship of free fatty acids with fat absorption suggests the involvement of other causative agents. These may be other surface-active agents which operate by lowering the surface tension at the dough-fat interface, or they may be polymeric materials which, by changing the viscosity and density of the frying fat, change the fat absorption through purely mechanical means. Carlin, Hopper, and Rockwood (4) found that heat oxidation is a major factor in the increased viscosity of frying fats, and Robinson, Black, and Mitchell (10) have proposed that polymers are substances which contribute to the foaming that occurs in highly deteriorated fat.

Surface-active agents can be produced in fat either by hydrolysis which yields free fatty acids and mono- and diglycerides, or by oxidation, to give various degradation products such as acids, aldehydes, and acrolein. These acids, which increase the titratable acidity, may be either short-chain free acids formed by splitting at the double bond, or acid groups formed on large molecules. Polymers are formed by addition mechanisms which involve the double bond. They are the result of either a Diels Alder type of addition, where conjugate double bonds are involved (9), or of a free radical mechanism probably involving the peroxides as initiators (11). This latter mechanism is more likely in all hydrogenated lard which contains a minimum of double bonds.

It has been the experience of the present authors that supposedly identical mixes, handled with all possible precautions to minimize variables other than fat condition, still yielded fat absorption values differing in amounts greater than could be accounted for by experimental error. The purpose of this study was to find to what extent the state of deterioration of the fat could be responsible for these discrepancies, what properties were involved, and, if possible, to find a way to maintain fat in such condition that its effect on fat absorption would remain constant.

To accomplish these purposes, the changes occurring in frying fat have been re-examined expressly for their correlation with the changes in fat absorption. An attempt was then made to isolate the related properties to find whether the relationship of each was incidental or causal.

Materials and Methods

In all experiments, except where otherwise stated, the frying shortening used was an "all-hydrogenated" lard with the following properties: a viscous, white solid at room temperature with a melting range from 40° to 50°C., iodine number 55–60, and FFA content of 0.05 to 0.07%. Fatty acids were added as a 1:1 mixture of USP-grade stearic and oleic acids. The monoglycerides used were commercial molecularly distilled products. Doughnuts were made from specially prepared cake doughnut mixes known to be sensitive to fat condition. These mixes were thoroughly blended and aged for at least 1 week before use to ensure equilibrium conditions. All frying experiments were carried out in a DCA Lincoln

fryer[1] mounted on a platform scale sensitive to 1/4 oz. All of the variables associated with changes in fat absorption were maintained constant, and the amount of fat absorbed by the doughnuts was determined by weighing the fryer before and after frying 7 dozen doughnuts. This method was found to be reproducible to ±0.07 oz. per dozen. Free fatty acids, iodine number, and specific gravity were determined by the official AOCS methods (3). Viscosity, except where otherwise specified, was measured at 212°F. (100°C.) in a steam-jacketed viscometer by timing the flow of 20 ml. of fat through a standard orifice, and is expressed as relative viscosity; that is, as the ratio of the viscosity of the sample fat to that of the fresh fat, determined under the same conditions.

Correlation of Fat Absorption with Changes in the Properties of a Frying Fat

The changes in free acidity, iodine number, viscosity (212°F.), and specific gravity (100°/25°) of fresh fat subjected to a normal frying schedule were examined and compared with the accompanying changes in fat absorption.

Starting with fresh fat, fryings were made once a day, with fat turnover of about 6% a day due to replacement of absorbed fat, until an FFA level of about 0.4% was reached. Thereafter, until the end of the experiment, five fryings a day, requiring a fat replacement of 25–30%, were made. Assurance that changes in fat absorption were not due to changes in the doughnut mix was gained by using the fat absorption in fresh fat as a reference. For further assurance that the mix employed was not unusual, doughnuts were prepared in the fresh and terminal fat samples with another similar mix.

TABLE I
FAT ABSORPTION AND FAT CHANGES DURING DOUGHNUT FRYING

Day of Frying	Fat Absorption Per Dozen		FFA	Iodine Number	Specific Gravity 100°/25°	Relative Viscosity 212°F. (100°C)
	Mix 1	Mix 2				
			%			
1	1.93	1.79	0.15	57	0.8916	1.00
2	1.86	...	.20	57	.....	...
3	1.86	...	.25	56	.....	1.03
4	2.00	...	.32	..	.....	...
5	1.86	...	.38	..	.....	...
6	2.07	...	.39	..	.....	...
7	2.07	...	.38	..	.....	...
8	2.14	...	.35	55	0.8935	1.07
9	2.07	...	.40	..	.....	...
10	2.29	...	.50	..	.....	...
11	2.43	...	.46	54	.....	1.10
12	2.29	...	.48	..	.....	...
13	2.57	...	.51	..	.....	...
14	2.50	...	.50	53	.....	...
15	2.43	2.14	.52	53	0.8943	1.10
[a]	1.86	...	.15	..	.....	...
[a]	1.93	...	0.16	..	.....	...

[a] Test fat replaced with fresh fat but same mix (No. 1) used.

Table I shows the changes in fat absorption and the accompanying chemical and physical changes in the frying fat.

The variations in the amount of fat absorbed by doughnuts due to changes in the properties of the fat can differ widely for different mixes. Fat absorption is correlated with titratable acidity expressed as FFA percent, specific gravity, and viscosity, and inversely with the iodine number of the fat. All of these changes have been previously reported (1,4,6,7). They can all be related to the presence of either surface-active materials or polymers. Thus the titratable acidity is associated with the surface-active agents present in fat, and density, viscosity, and iodine number are all related to the formation of polymers (2,4,10).

Addition of Surface-Active Materials to Fresh Fat and Their Effect on Fat Absorption

To find to what extent surface-active agents in frying fat can affect fat absorption, two representative materials — fatty acids and monoglycerides — were added to fresh fat in varying amounts and their effect on fat absorption noted.

TABLE II
EFFECT OF SURFACE-ACTIVE ADDITIVES

Frying Fat Used	Fat Absorption
	oz/doz
A — fresh frying fat	1.93
B — fat A + 0.49% fatty acid mixture	1.93
C — fat B + 0.5% monoglycerides	2.14
D — fat C + 0.73% fatty acid mixture	2.21
E — fat D + 0.8+ monoglycerides	2.07

The results (Table II) show that the addition of fatty acids to fresh fats in amounts normally present in commercial frying does not affect fat absorption. Monoglycerides at a similar level did affect fat absorption to a slight extent, but further increases in either free fatty acids or monoglycerides to levels present in excessively abused fat had no measurable effect. Other unknown surface-active agents, produced by oxidation, may be concurrent and have a more pronounced effect on fat absorption, but so far no evidence has been found for any such hyperactive materials.

Correlation of Fat Absorption with Viscosity

The elimination of the two most likely surface-active agents as prime causative factors leads to consideration of the dependence of fat absorption upon viscosity. Since there were no means available for increasing the viscosity of the fresh fat without changing other properties, an indirect correlation with viscosity (in which other possible causative factors could be assumed to be random) was attempted. Two approaches were used.

Fat was heated oxidatively to a titratable acidity of over 1%, and fat absorption, FFA percent, iodine number, and viscosity were determined. This fat was then diluted to various concentrations with fresh fat and the same properties were remeasured. These results were compared with similar determinations made on fresh fat and on fats obtained by normal frying.

In the second approach, eight different frying fats were used: three fats of vegetable origin with dilatometric properties corresponding to "all-hydrogenated," compound, and pure oil; and five lards, two of which were "all-hydrogenated," two compound, and one pure lard. The fats were brought, by heating and frying, to an FFA level of 0.45%. Fat absorptions and viscosities were de-

[1] DCA Food Industries Inc., 45 West 36th St., New York, N. Y.

termined on all of these fats.

In this experiment viscosities were determined at both 212° and 294°F. (145.5°C.). This latter temperature was selected since it had been found that the viscosity-temperature curves for different types of fat were not parallel and that the temperature at which viscosity was measured could be a factor in the degree of correlation between viscosity and fat absorption; 294°F. lies halfway between the temperature of the fat (375°F.) and the temperature at the surface of the dough (212°F.). This is the most likely temperature for the film of fat surrounding the doughnut during frying.

TABLE III

VARIATION OF THE FAT ABSORPTION WITH PROPERTIES OF FRYING FATS PREPARED IN DIFFERENT WAYS

Sample No.	Fat Absorption	Relative Viscosity at 212°F. (100°C.)	Iodine Number	FFA	Sample Preparation
	oz/doz			%	
1	2.58	1.84	40	1.22	Fat heated
2	2.45	1.22	47	0.47	Fat 1 diluted with fat 6
3	2.14	1.12	52	0.26	Fat 2 diluted with fat 6
4	2.07	1.09	53	0.47	From normal frying
5	1.93	1.07	55	0.26	From normal frying
6	1.86	1.00	57	0.06	Fresh fat

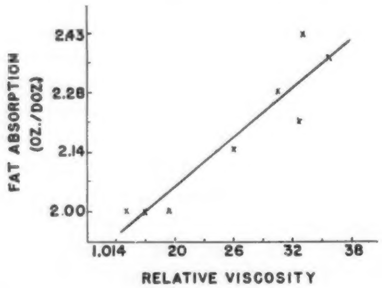

Fig. 1. The relationship between fat absorption and the relative kinematic viscosity at 294°F. for eight fats differing in source and type.

The results of both experiments definitely link viscosity with fat absorption. This is true for the dilution experiment (Table III), but is especially dramatic in the case of the eight different frying fats (Fig. 1). The correlation coefficient for the viscosity at 294°F. and the fat absorption was 0.84, which is in the 99% probability range. At 212°F. the correlation coefficient was 0.78 which is also a significant correlation in the 98% probability range. The higher correlation at 294°F. might be due to experimental error, but it is more likely that the viscosity at this temperature more nearly approximates that of the fat film surrounding the frying doughnut. There was, of course, no correlation with titratable acidity, which was the same for all eight fats. This lack of correlation was also evident in the dilution experiment. The correlations of this property with fat absorption obtained previously are thus shown to be purely coincidental and can be useful only under very specific conditions.

Since it is unlikely that an unknown factor could have been produced at the same rate as the increase in viscosity, considering the diverse composition and treatments of the samples, it is almost certain that viscosity itself is the factor most likely to be responsible for the changes in fat absorption which result from deteriorating fat.

This leads to speculation as to the specific mechanism through which viscosity can operate. The first that readily comes to mind is based purely on coating action. Variations in viscosity will be accompanied by changes in the thickness of the fat film on the doughnut due to cohesion. It has been calculated that an increase in film thickness of 0.002 in. on the doughnut leaving the fryer would cause a significant change in fat absorption.

Another possibility, and one that is more fundamental in that it could also explain other doughnut changes, is the effect that viscosity might have on the heat-transfer properties of the fat. Studies now in progress in this laboratory suggest that, indeed, such an effect does exist. Changes in the rate at which heat can penetrate the dough can affect such fundamental systems as leavening, gelation, and coagulation, and can lead to all of the aberrations which have been observed in doughnut frying.

Maintenance of Frying Fat in the Quality Control of Doughnuts

To find if fat could be eliminated as a variable in controlled doughnut frying, the conditions necessary to maintain the fat so that it would not be a factor in fat absorption were investigated.

Fat in a fryer which was being used for the normal routine of a control laboratory was checked each day for viscosity and FFA percent, and, where necessary, fat was withdrawn and replaced with fresh fat in order to maintain the FFA in a range of 0.40–0.45% and the relative viscosity in a range of 1.06–1.08. The fat absorbed by the doughnuts was checked periodically over a 2-month period.

During this period the normal level of fat turnover was such that artificial replacement to maintain the FFA and viscosity level desired was necessary only twice, at which times 10% (2 lb.) of the fat was replaced. Both of these replacements were necessary at times when turnover due to fat absorption dropped below 30%. At all other times the turnover for an 8-hour day varied between 30 and 60%. The fat absorption of the test mix remained constant. Thus it has been demonstrated that, with high enough fat turnover (which can be obtained through ordinary frying in a properly designed fryer), fat will not change with respect to fat absorption. Results indicate that, when time-consuming viscosity measurements are impractical, the titratable acidity (FFA percent) can be substituted as a gage for fat condition, provided that its limitations are kept in mind. The indiscriminate use of fats, improper fryer design, or frying habits, as outlined by Carlin *et. al* (4), would make the use of viscosity measurements rather than titratable acidity essential as the control property.

Acknowledgment

The authors are indebted to C. Ofelt and B. Pincus for their assistance in the preparation of this paper.

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MILLING, BAKING, AND CHEMICAL PROPERTIES OF MARQUIS AND KANRED WHEAT GROWN IN COLORADO AND STORED 25 TO 33 YEARS

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A NUMBER OF STUDIES have been made to determine what factors affect the successful long-time storage of wheat on the farm and in commercial grain elevators. There has also been much discussion concerning the length of time that wheat can be stored and still remain viable or usable for milling and baking. The opportunity to secure some information on these questions arose in 1938 when samples of two varieties of wheat stored for a number of years at the Colorado Agricultural Experiment Station were tested for quality.

Briefly, the studies herein reported were limited to Marquis spring wheat grown under irrigation and Kanred winter wheat grown on fallow without irrigation. After threshing and cleaning, the grain was stored in 100-lb. sacks in a dry, unheated room. The annual precipitation and average annual humidity at Fort Collins, Colorado, for the first 17 years of storage are given by Robertson and Lute (7), who discussed the possible relation of these to storage. The moisture content of the grain at the time of storage was not determined, but it is believed to have been relatively low.

The quality characteristics of various lots of Marquis and Kanred wheat varieties grown at Fort Collins and stored for different periods were reported first in 1938 (6) after 9 to 17 years' storage, again in 1943 (3) after 14 to 22 years' storage, and in 1948 (4) after 19 to 27 years' storage. Portions of these same lots of wheat have been continued under storage and were sampled for a fourth time in the spring of 1954 (after 25 to 33 years' storage) for milling, baking, and chemical properties and germination tests. A sample of Marquis and Kanred grown in 1953 at Fort Collins on the same land on which the long-stored samples were first grown was included in the 1954 tests for comparative purposes. It is believed that these recently grown samples of the same variety might be helpful in appraising the storage data, especially since no tests were made until 1938 on the wheats harvested in 1921 to 1929 and placed in storage.

Sources of Samples

The samples consisted of the Marquis variety from each of nine crop years from 1921 to 1927 inclusive, and of the 1929 and 1953 crops; and the Kanred variety from each of the four crop years 1921, 1924, 1929, and 1953. In the later years of storage there was considerable damage to the grain by the dermestid beetle, *Trogoderma tarsale.* The grain was cleaned at least once every 2 years with a fanning mill to remove insect-damaged kernels, and the storage room was sprayed with a mixture of ethylene dichloride three parts, and carbon tetrachloride one part by volume to control insect pests, as recommended by Roark and Cotton (5).

Methods

The tempered wheats were milled to 90% patent flours on an Allis-Chalmers experimental flour mill. None of the lots required special tempering treatment or unusual milling technique for the production of satisfactory flour. Chemical tests (moisture, ash, protein, thiamine, and fat acidity) were made by accepted and approved AACC methods (1).

The bread-baking tests by the straight-dough method were made by using a formula consisting of 100 g. flour, 2.0 g. compressed yeast, 1.5 g. salt, 5.0 g. sugar, 3.0 g. shortening, 4.0 g. nonfat dry milk, and different amounts (0 and 1 mg.) of potassium bromate. The doughs were fermented for 3 hours at 86°F. (30°C.), panned, proofed for 55 minutes at 86°F., and then baked for 25 minutes at 450°F. The milling, baking, and chemical tests made in 1954 on these samples were conducted by the same methods used in 1938. Any differences in the properties of the wheat between the lots stored for various periods probably are due to the storage and not to differences in methods of testing.

[1] Authorized by the Director of the Colorado Agricultural Experiment Station for publication as Scientific Journal Series Article No. 558.

Results and Discussion

The milling, baking, and chemical results obtained in 1938 and 1954 are shown in Tables I and II. The thiamine contents of the samples drawn in 1954 are shown in Table III and the germination data in Table IV. Table IV includes the percentage of germination for each lot 6 months after harvest and at the end of various periods of storage up to 33 years. The loaves of bread baked from Marquis are shown in Fig. 1 and those from Kanred in Fig. 2.

The test weights of the grain were slightly but consistently lower for the samples taken in 1954 than for those taken in 1938 except for the 1924 Kanred, which was the same. The stored grain has varied from 9.0 to 12.5% in moisture content over the different years, most of the samples averaging less than 11%. A high moisture content can be one of the common causes for wheat going out of condition, particularly during hot weather. The climate at Fort Collins, Colorado, where the wheats have been stored is generally cool and the rainfall and humidity are relatively low. The low humidity accounts for the relatively low moisture contents of the wheats kept in storage up to 33 years. The differences in moisture contents between the stored wheats were small and are not believed to be important. The moisture contents of all the wheats were well within the limits for safe storage.

The yields of flour from the Kanred samples taken in 1954 were higher (except for the 1929 Kanred) than in 1938 and averaged better than those of the samples of Marquis when compared on the basis of comparable test weights. The ash contents of the wheats were substantially the same for the grain sampled in 1954 and in 1938. The ash contents of the flour, however, have averaged consistently higher in lots drawn since 1938, perhaps because of the more brittle bran coat of the wheat. The increase in ash content of the flour from some of the samples has been as much as 0.16% for the grain stored up to 33 years. The ash contents of the samples of Marquis and Kanred grown in 1953 were higher than many of the long-stored varieties. The higher yields of flour for some of the lots of Marquis stored for a long time might possibly have contributed to some of the higher ash contents

TABLE I

MILLING, BAKING, AND CERTAIN OTHER PROPERTIES OF MARQUIS (IRRIGATED) WHEAT AFTER STORAGE FOR VARIOUS PERIODS (25 TO 33 YEARS)
(Grown and stored at the Colorado Experiment Station, Fort Collins)

ANALYSIS	YEAR GROWN (G) AND YEARS TESTED (T)																
	G 1921		G 1922		G 1923		G 1924		G 1925		G 1926		G 1927		G 1929		G 1953
	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1954
Wheat:																	
U. S. Grade[a]	3 DNS	1 DNS	2 DNS	1 HDNS	4 DNS	1 DNS	3 NS	1 HNS	4 NS	2 NS	3 DNS	1 HDNS	2 DNS	1 DNS	1 HDNS	1 HDNS	1 HNS
Test weight, lb.[b]	59.2	58.7	61.5	61.1	60.0	58.9	62.4	61.9	57.1	57.0	63.1	62.1	60.4	59.8	62.6	62.1	62.1
Flour yield, %[c]	70.7	74.1	72.7	73.4	70.6	72.1	72.3	73.1	69.3	69.2	73.7	73.2	72.5	74.6	72.7	73.6	74.6
Protein, %[d]	14.4	14.1	13.7	13.6	13.6	13.5	12.6	12.3	11.3	11.2	12.6	12.9	14.5	14.3	13.5	13.5	12.0
Ash, %[d]	1.74	1.82	1.56	1.59	1.74	1.65	1.64	1.62	1.84	1.70	1.48	1.43	1.46	1.35	1.54	1.46	1.80
Moisture, %	10.7	9.8	11.0	9.8	10.5	9.8	10.4	9.7	10.5	9.0	10.6	9.8	10.5	10.1	10.6	10.0	10.9
Fat acidity[e]	48	71	43	64	47	73	35	53	43	65	32	61	31	54	26	46	13
Increase in fat acidity, above 1938, %		48		49		55		51		51		91		74		77	
Flour:																	
Protein, %[d]	13.6	13.1	13.1	12.4	12.7	12.9	11.7	11.4	10.8	10.3	12.1	11.9	13.8	13.1	12.4	12.1	11.1
Ash, %[d]	0.43	0.55	0.40	0.56	0.43	0.52	0.44	0.52	0.45	0.54	0.40	0.52	0.34	0.38	0.32	0.39	0.51
Gassing power, mm, total	273	235	185	165	148	182	213	205	281	207	216	173	153	160	154	170	230
Diastatic activity, mg.[f]		114		94		102		107		119		107		85		93	107
Bread (commercial bake):																	
Optimum bromate, mg.	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	1
Absorption, %	64.0	62.0	64.0	62.0	64.0	63.0	64.0	63.0	64.0	63.0	64.0	64.0	64.0	63.0	64.0	61.0	62.0
Loaf volume, cc.	709	626	604	605	672	567	583	577	622	576	610	561	645	595	670	570	668
Crumb color, score	95 Cr	85 Cr	80 Cr	90 Cr	90 Cr	85 Cr	85 Cr	80 Cr	85 Cr	75 Cr	90 Cr	85 Cr	95 Cr	90 Cr	100 Cr	90 Cr	75 Cr
Grain and texture, score	85 VG	80 G	75 G	75 G	90 VG	60 P	75 G	75 F	80 G	60 F	80 G	60 F	90 VG	60 F	90 VG	60 P	80 VG

[a] Lower commercial grade assigned in 1938 because of weevil-damaged kernels.
[b] Dockage-free.
[c] Moisture-free.
[d] 14.0% moisture basis.
[e] Milligrams of potassium hydroxide per 100-g. sample (moisture-free basis).
[f] Milligrams per 10 g. of flour.

TABLE II

MILLING, BAKING, AND CERTAIN OTHER PROPERTIES OF KANRED (NONIRRIGATED) WHEAT AFTER STORAGE FOR VARIOUS PERIODS (25 TO 33 YEARS)
(Grown and stored at the Colorado Experiment Station, Fort Collins)

ANALYSIS	YEAR GROWN (G) AND YEARS TESTED (T)						
	G 1921		G 1924		G 1929		G 1953
	T 1938	T 1954	T 1938	T 1954	T 1938	T 1954	T 1954
Wheat:							
U. S. Grade[a]	3 DHW	2 DHW	3 DHW	1 DHW	1 DHW	1 DHW	2 DHW
Test weight, lb.[b]	59.8	59.4	62.6	62.6	61.8	61.4	58.7
Flour yield, %[c]	74.2	74.6	75.2	75.5	73.7	73.5	72.5
Protein, %[d]	14.3	13.9	12.9	12.4	12.7	12.9	12.5
Ash, %[d]	1.46	1.39	1.26	1.25	1.16	1.21	1.60
Moisture, %	10.6	10.0	10.5	9.7	10.6	9.7	9.8
Fat acidity[e]	38	58	32	53	27	53	12
Increase in fat acidity above 1938, %		53		66		96	
Flour:							
Protein, %[d]	13.5	12.7	12.0	11.4	12.5	11.9	11.4
Ash, %[d]	0.33	0.47	0.32	0.45	0.32	0.42	0.42
Gassing power, mm. total	255	235	197	205	177	195	190
Diastatic activity mg.[f]		110		112		97	103
Bread (commercial bake):							
Optimum bromate, mg.	1	1	1	1	1	1	1
Absorption, %	64.5	63.0	64.0	63.0	62.0	63.0	61.0
Loaf volume, cc.	737	665	644	615	691	656	678
Crumb color, score	90 Cr	90 Cr	90 Cr	80 Cr	90 Cr	100 Cr	75 Cr
Grain and texture, score	100 VG	75 G	90 VG	65 F	95 VG	75 G	85 VG

[a] Lower commercial grade assigned in 1938 because of weevil-damaged kernels.
[b] Dockage-free.
[c] Moisture-free.
[d] 14.0% moisture basis.
[e] Milligrams of potassium hydroxide per 100-g. sample (moisture-free basis).
[f] Milligrams per 10 g. of flour.

Fig. 1. Bread baked in 1954 from Marquis wheat grown in the years 1921 to 1927 and in 1929, 1948, and 1953.

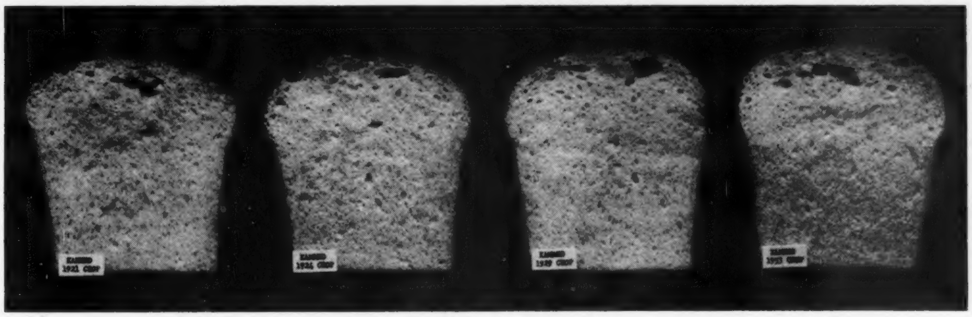

Fig. 2. Bread baked in 1954 from Kanred wheat from the crop years 1921, 1924, 1929, and 1953.

of the flour. There has been a consistent increase in the flour ash content of Kanred which, however, cannot be attributed solely to flour yield. The brittle condition of the grain mentioned was not apparent from inspection of the wheats or in handling properties in the mill. Every attempt has been made to mill the samples in a like manner in the various years. It appears that conditions of storage have not materially altered the milling characteristics of the different lots of grain with respect to yield of flour.

There are no important differences between the wheat protein contents of the samples from the same lots tested in the different years. The slight loss in protein content (0.3% or more) in four of the eleven comparative tests should perhaps be attributed to sampling error. The only sample showing an increase was the 1926 Marquis. Shutt (8,9) demonstrated a progressive though small increase in protein content of wheat during extended storage, which was explained as a percentage increase resulting from a loss in carbohydrate by respiration.

Fat acidity determined on the samples taken in 1954 showed increases ranging from 48 to 91% for the Marquis samples and from 53 to 96% for the Kanred samples, as compared with the samples taken in 1938. The smallest percentage increases occurred in the Marquis grown in 1921 and 1922. The greatest percentage increases were in the 1926 crop Marquis and the 1929 crop Kanred. Fat-acidity values for none of the Marquis samples taken in 1954 were lower than 46 and the highest value recorded was 73 for the 1923 crop sample. The 1953 crop Marquis (included in this study for comparative purposes) had a value of 13 and the 1953 crop Kanred had a value of 12, which is perhaps slightly lower than the usual for normal, freshly harvested wheat. It is generally considered that fat-acidity values in excess of about 20 indicate at least incipient deterioration, but in the present study such deterioration as may have occurred was in some instances not generally reflected in the baking quality of the flour.

Gassing-power determinations made on the flour as an indication of diastatic activity reveal some differences for the lots harvested in different years. The tests made on the flour from six of the eleven samples taken in 1954 were all somewhat lower in gassing power than the samples taken in 1938. The diastatic activity, as determined chemically on the samples taken in 1954, was relatively low. The gassing-power values based on the 1954 results were more nearly alike for the same variety stored for

various periods than in previous years' tests. The 1921 crop of Marquis, however, was highest in gassing power and the 1924 and 1925 Marquis samples were second best. For Kanred the values were highest in 1921 and lowest in 1929, and about the same as the values for freshly harvested samples from the 1953 crop. It is not apparent from the 1954 data that long storage is associated with either an increase or a decrease in gassing values. These results are not in general agreement with the conclusions drawn when the last tests were made in 1948, indicating that the gassing power increased with length of storage.

Baking Test

Bread was made from the flour in the 1954 tests, with the same formula as in the past testing periods. The baking results indicate that the loaf volume of the bread in all but four of the samples was substantially the same as for those taken in 1938. The bread made in 1954 from the 1921 Marquis showed a decrease of 83 cc. in loaf volume, the 1923 Marquis a decrease of 105 cc., the 1929 Marquis a decrease of 100 cc., and the 1921 Kanred a decrease of 72 cc., compared with the 1938 results. None of these differences, however, seem to be greater than might be expected from the difficulty of exactly duplicating the conditions when tests are made 16 years apart. (See Figs. 1 and 2.)

The 1921 crop Marquis which had been stored longer than any other gave a little higher loaf volume, and was materially better in grain and texture than either the 1927 or the 1929 Marquis. The protein contents of the flours from the 1921 and the 1927 samples were the same, and both were higher than those of the 1929 sample. The 1921 Marquis made bread about equal to that from the Marquis harvested in 1953, when differences in protein content are considered. Also, there was generally a decrease in the grain and texture scores of the bread made from both the Marquis and the Kanred, when comparisons are made according to variety for the tests made in the different years.

The 1921 Kanred made bread that was about equal in quality to that from the 1924 and 1929 samples. Except for grain and texture, there appears to be little difference in quality between the Kanred stored a long time and the sample harvested in 1953.

Doughs from the 1921, 1923, 1924, 1925, 1926, and 1929 Marquis samples were slightly short and sticky and were generally not so elastic and pliable as the doughs from the Marquis harvested in 1953. It would seem reasonable to conclude that the weaker dough properties are apparently a result of some deterioration resulting from long storage of the wheats. The 1922 and 1927 Marquis samples, however, were relatively satisfactory in dough properties. The doughs of the 1921, 1924, and 1929 Kanred were relatively strong and were mellow and pliable. These samples were substantially the same in this respect as the Kanred harvested in 1953, which was included in the tests for comparative purposes.

Observations of the dough-handling properties appear to indicate that Kanred has suffered less injury from storage than Marquis.

The response to an oxidizing agent such as potassium bromate used in the bread formula has been considered an interesting characteristic of a flour used in the making of yeast-leavened products such as pan bread. Baking tests made on the Marquis samples taken in 1938 show that generally there was a small negative response (less than 60 cc.) in loaf volume in all the samples when 0.001% potassium bromate was included in the bread formula. This was similar to the response found in the lots of Marquis taken in 1954. The 1921, 1924, and 1929 samples of Kanred taken in 1938 and again in 1954 increased slightly (43 to 62 cc.) in loaf volume when bromate was added. It is apparent from these data that the response to bromate is not associated with length of storage.

Vitamin B_1 (Thiamine) Assays

Thiamine determinations by the thiochrome method (1) were made on samples taken in 1954 from wheats stored for the different periods. The results of these tests are given in Table III. The Marquis wheats stored 25–33 years and sampled in 1954 varied from 1.58 mg. per lb. for the 1925 sample to 2.00 mg. per lb. for the 1927 sample. The thiamine contents of the Kanred lots stored 25–33 years and sampled in 1954 were lowest for the 1921 sample and highest for the 1929 sample. Since no determinations of thiamine were made in 1938 when the samples were first tested, it is impossible to determine accurately from these data the effect of storage on thiamine content. A sample of Marquis and Kanred wheat grown in 1953 at the same location where the stored varieties were produced assayed 2.23 and 1.87 mg. per lb., respectively, of thiamine. The stored Marquis and Kanred samples averaged slightly lower than the same varieties grown in 1953, included for comparative purposes.

TABLE III
VITAMIN B_1 (THIAMINE) CONTENT OF WHEAT SAMPLES DRAWN IN 1954

Variety and Crop Year		Sampled in 1954: Years after Harvest	Sampled in 1954: Thiamine
			mg/lb
Marquis	1921	33	1.99
	1922	32	1.74
	1923	31	1.96
	1924	30	1.90
	1925	29	1.58
	1926	28	1.84
	1927	27	2.00
	1929	25	1.85
	1953	..	2.23
Kanred	1921	33	1.60
	1924	30	1.69
	1929	25	1.70
	1953	..	1.87

The data presented herein, considering the known variation in thiamine content of wheat of different crops as shown by other investigators, indicate that under conditions of this experiment there has probably been no significant loss due to storage.

Bayfield and O'Donnell (2) determined the thiamine content of a number of samples of apparently sound whea

of varying ages up to 51 years. The very low values obtained for some of the older samples (although no data on the original thiamine content of the samples were available for comparison) indicated that considerable loss in thiamine must have occurred. Some of the samples as much as 21 years old, however, still had fairly high thiamine content and therefore had apparently not suffered very heavy losses of thiamine during these long periods of storage.

Germination Tests

The germination tests made after 6 months' storage and again in 1954 are shown in Table IV. All samples germinated well when the first tests were made, the lowest being 93.0% for the 1923 Marquis and 1929 Kanred. The tests made during the different storage periods reveal marked differences, the wheat stored the longest being lowest generally in germination, as would be expected. By 1954 the 1921 Marquis and Kanred, stored for 33 years, and the 1924 Kanred, stored for 30 years, showed no germination. The Kanred samples stored for 25 and 30 years showed respectively 7.8 and 12.3% lower germination than samples of Marquis stored for the same length of time under the same conditions. In general, Kanred decreased somewhat faster in percentage germination than Marquis when comparisons were made for lots harvested in the same years. Fair to good bread was made from samples that germinated very poorly.

TABLE IV
GERMINATION PERCENTAGE OF WHEAT STORED FOR VARIOUS PERIODS AFTER HARVEST

VARIETY AND CROP YEAR	SIX MONTHS AFTER HARVEST	1954 TESTS: YEARS AFTER HARVEST	GERMINATION
	%		%
Marquis			
1921	98.0	33	0.0
1922	97.5	32	1.0
1923	93.0	31	3.0
1924	93.5	30	12.3
1925	97.5	29	4.0
1926	95.5	28	11.6
1927	98.5	27	16.3
1929	97.0	25	14.4
1953	94.8	..	...
Kanred			
1921	95.0	33	0.0
1924	94.0	30	0.0
1929	93.0	25	6.6
1953	96.8	..	..

Summary

Samples of Marquis, a spring wheat grown under irrigation, and Kanred, a winter wheat grown on fallow without irrigation, were stored at Fort Collins, Colorado, in bags in a dry unheated room for periods up to 33 years. The 1921 Marquis and Kanred stored 33 years and the 1924 Kanred stored for 30 years failed to germinate. Samples stored up to 33 years showed different degrees of germination which were not directly related to time of storage. Kanred decreased somewhat faster in percentage germination than Marquis when comparisons are made for lots harvested in the same years. Storage had no consistent effect on protein content of grain, but about one-third of the samples showed a slight apparent loss of protein during storage. The ash content of the wheat did not change, but the ash content of the flour averaged consistently higher in lots drawn since 1938.

There was a definite and fairly regular increase in fat acidity with storage, indicating a certain amount of progressive deterioration. Deterioration, however, was not as apparent when measured by the bread-baking tests as might be expected, considering the marked increase in fat acidity. The increase in fat acidity for Marquis and Kanred was about the same when comparisons were made for samples stored for the same period.

The gassing-power determinations made in 1954 on the flour, as a measure of the diastatic activity, showed a decrease on six of the eleven lots of flour samples, in contrast to the 1938 samples.

The quality of the bread, as judged by loaf volume, was in all but four cases substantially the same as for the samples taken in 1938. There has been a gradual and important decrease in the bread grain and texture for eight of the eleven lots of stored wheat since they were first tested in 1938. The inclusion of an oxidizing agent such as potassium bromate in the formula produced no marked change in the loaf volume of the breads made from the stored wheats. It is apparent from these studies that the response to an oxidizing agent is not associated with length of storage.

Determinations of thiamine content of the samples taken in 1954 indicate that the differences were no greater than might reasonably be expected between samples of different crop years.

Acknowledgment

Credit is due Ray Weaver, J. F. Hayes, E. Hoffecker, Reba Renn, and T. Hartsing, Grain Division, Agricultural Marketing Service, U. S. Department of Agriculture, for making some of the determinations reported in this paper; and to Elizabeth Hewston, Food Analysis Section, Institute of Home Economics, U. S. Department of Agriculture, for determining the vitamin B_1 (thiamine) content of the wheats drawn in 1954.

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• • • People

R. W. Bates elected vice president of American Oil Chemists' Society and took office at the 50th anniversary in New Orleans April 22. Bates, who is also an AACC member, has been secretary of AOCS.

M. M. Benidt, G. T. Everett, J. H. Green, and **D. A. Stevens** of General Mills, Minneapolis, were in Caracas, Venezuela, recently for the ceremonies opening the new flour mill there, Grandes Molinos de Venezuela. General Mills brands of flour will be produced, for the first time outside the North American continent.

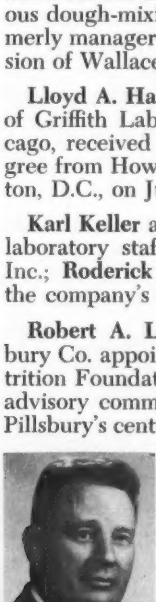
Mortimer W. Brenner elected president of American Society of Brewing Chemists for 1959-60; is vp and director of brewing, Jacob Ruppert Brewery, New York City.

R. M. Finch appointed by Baker Process Co., a division of Wallace & Tiernan, Inc., as sales representative in Georgia, Florida, and Alabama for the Do-Maker, a continuous dough-mixing process; was formerly manager of flour service division of Wallace & Tiernan.

Lloyd A. Hall, technical director of Griffith Laboratories, Inc., Chicago, received Honorary D.Sc. degree from Howard Univ., Washington, D.C., on June 5.

Karl Keller and **Albin Wilko** join laboratory staff of Fries & Fries, Inc.; **Roderick West** appointed as the company's technical manager.

Robert A. Larsen of The Pillsbury Co. appointed member of Nutrition Foundation's food industries advisory committee; is manager of Pillsbury's central research division.



Jess A. Meininger elected vp of production, quality control, and sales service of Trenton Milling Co., Trenton, Ill. Mr. Meininger will be responsible also for the company's newly created customer technical service. He is an authority in the field of chemical leavening.

Max Milner, a Kansas State University scientist and active member of the AACC, has been selected for international responsibilities with the United Nations organization.

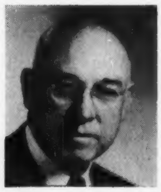
He is to be senior food technologist in the food conservation division of the United Nations International Children's Fund, with headquarters in the UN Building in New York City, beginning August 1.

Dr. Milner is to plan and implement a research program in technological aspects of high-protein and other foods for food-deficient areas of the world. He will work with engineers and nutritionists in analyzing and developing procedures to process foods, test their acceptability, and market them in connection with the UNICEF, Food and Agriculture Organization (FAO), and the World Health Organization (WHO). He will also maintain liaison with professional, governmental, and industrial persons associated with food technology.

A member of the K-State staff since 1947, Milner has resigned, effective July 31. During his more than 12 years on the K-State staff he has been author or co-author of more than 60 professional and scientific journal articles dealing with various problems of food technology.

In addition to his work at Kansas State University, Milner has been sent abroad twice within the last five years as a food technology consultant — to Rome, Italy, and Israel in 1954 and to Israel in 1958.

Ray O'Halloran is setting up new malt sales office for Northwestern Malt & Grain Co. in Cleveland, Ohio; was manager of barley department, Froedtert Malt Co., before joining Northwestern at Minneapolis a year ago as malt salesman.



William L. Rainey heads new products department of Commander Larabee flour milling division of Archer - Daniels - Midland Co., Minneapolis; will work on new wheat flour blends and formulations, and explore new market areas for these products in the baking industry and other segments of the food industry. Was formerly technical director for CL. **Lawrence J. Warren** becomes director of products control for the division; has been in charge of control laboratory at CL's flour mill at North Kansas City, Mo.

A. M. Schlehuber, professor of agronomy at Oklahoma State University, will begin a year's leave in September under a Fulbright Lectureship. He will lecture on plant breeding and will attend lectures and seminars at the Technical Institute, Munich, Germany. He also will work with wheat research groups at the Institute and other research organizations. Dr. Schlehuber has headed Oklahoma's small grains improvement and testing program since 1945.

Nathan Stein elected assistant secretary to Florasynth Laboratories, Inc.; has been associated with Florasynth since 1946 at their head offices in New York City, as accountant and controller.

Robert C. Wornick joins staff of department editors, **This Journal,** as Feed Technology editor. Dr. Wornick is chemical engineer and head of chemical laboratories in the Agricultural Research & Development department of Chas. Pfizer & Co., Inc., Terre Haute, Ind.; has been with the company since 1942 in this and other capacities.


Happy
Sorbistat-K

• • • **Patter**

"Food Chemical News." Issued in loose-leaf page form, this "specialized weekly publication" was launched recently by Louis Rothschild, Jr., to meet industry needs for information about legislative and administrative developments affecting food chemicals. Mr. Rothschild was previously editor of **F-D-C Reports**, an independent publication in drugs and cosmetics. With basic policies in formulative stages and the situation in many areas in a state of flux, Mr. Rothschild recognized the need for such authoritative, up-to-date news coverage. Write to: Food Chemical News, 1011-12 Warner Bldg., Washington 4, D.C.

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Wallerstein's new address. The Wallerstein Co. moved into its new general office and administration building at Mariners Harbor, Staten Island, which is the location of its principal manufacturing plant and laboratories, on May 1. Visitors are welcomed, and communications should be sent to the new address: Wallerstein Square, Mariners Harbor, Staten Island 3, N.Y.

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"Givaudan Flavorist." The latest issue of this 8-page, well-turned-out pamphlet distributed by Givaudan Flavors, Inc., features a current appraisal of pressurized foods; their history, and problems now confronting the food manufacturer. Requirements of propellants are outlined, and reformulation of the product, usually required for aerosol packaging, is discussed. The company predicts a definite future for the aerosol package in the food industry, with cooperative effort between development and marketing. They look forward to seeing such products as cake icings, pancake and cake mixes, salad oils, and dressings packaged in pressurized containers; in addition, new food items will be realized solely as a result of aerosol research. "The Flavorist" will place your name on its mailing list if you so request: Givaudan Flavors, Inc., 321 W. 44th St., New York 36, N.Y.

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Merck booklet on enrichment. "Your refresher course on enrichment," a 22-page booklet just published by Merck & Co., Inc., poses questions important to producers of enriched food products: "What does the dietary labeling statement really mean, and how can it work to my advantage? How do enrichment ingredients safeguard health? What is the story behind the enrichment program?" These and other questions vitally important to business from standpoints of marketing, sales, advertising, and production are answered. Means of adding enrichment ingredients to cereal products are described, as well as the best ways of using enrichment wafers or mixtures. Federal standards of identity and dietary labeling for enriched foods are outlined in the center spread. Specific standards and labeling requirements for bread, flour, farina, corn meal and grits, rice, pastina, and macaroni products are itemized in a ready-reference table. Millers, bakers, cereal manufacturers, and others will find this book a handy reference guide as well as "a refresher course." Copies are available from Merck & Co., Inc., Chemical Division, Rahway, N. J.

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Flavor demonstration. During the recent AACC annual convention, Fries & Fries, Inc., manufacturers of flavors, aromatics, essential oils, and perfumes, demonstrated the use of some of their newest flavoring compounds to

association members. Pictured in the Fries & Fries booth are, left to right: Mat H. Nash, American Breddo Corp., New York City; Dennis Daugherty, Borden Foods, East Point, Ga.; Malcolm Whiteford, Borden Foods, Los Angeles; Louis Mignacca, F&F New York representative; and Mr. and Mrs. Robert G. Fries, Jr., of Cincinnati.

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Brewing Chemists' papers. Among 26 papers presented at the recent ASBC annual meeting in Montreal, two were given by AACC members who have been frequent contributors to **Cereal Chemistry**, both of the Grain Research Laboratory, Winnipeg. W. O. S. Meredith reported on studies on wort nitrogen in barley. E. J. Bass and Dr. Meredith contributed together the sixth of their series of papers on enzymes that degrade barley gums, discussing the relations between barley gum composition, cytolytic activity, and malting quality.

Other papers were mainly on malt and on brewing, and included studies of malt assortments and grists; nitrogen metabolism; chromatography and spectrophotometry; gas chromatography of volatiles and in flavor definition; reducible disulfides; porphyrins; chlorides; use of the immersion refractometer; nomograph technique in refractometric analysis; barley malting quality; malt modification; British system of malt analysis; effect of growth regulators on barley malt; radioactive carbon in malt gums and tannins; extract determination of cereal adjuncts; yeast strains and viability of yeast.

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Cargill facilities expand. Storage space for 3 million bu. of grain is to be added this summer to the Chicago terminal elevator of Cargill, Inc. (now holding 17 million bu.), making it the largest on the Great Lakes. Three circular steel tanks will be added, each holding 1 million bu., diameter 160 ft., rim height 48 ft., center height 91 ft. Capacity of Cargill's elevator at Baton Rouge, La., has recently been expanded from 7.5 million to 5 million bu., making this the largest export elevator on the Gulf Coast. It is owned by the Baton Rouge Port Commission and operated by Cargill.

EMPLOYMENT NOTICES

the President's Corner

news of the association

Review of Food Protection Committee Activities during 1958

The Food Protection Committee continued its activities, dealing particularly with possible public-health problems associated with the use of chemicals in food production, processing, packaging, and storage. Three reports were completed during the year. They are:

1. Insignificant levels of chemical additives in foods. *Food-Drug-Cosmetic Law Journal 12*:477 (1958)
2. Food packaging materials: Their composition and uses. NAS-NRC Publication 645, November 1958
3. The safety of polyoxyethylene (8) stearate for use in foods. NAS-NRC Publication 646, December 1958

The Committee's activities are largely carried on by subcommittees. Some of the current activities are outlined.

The Subcommittee on Food Technology held a symposium.

In three meetings held since January, the Subcommittee on Carcinogenesis has examined available information on the comparative carcinogenicity of material when 1) administered to various species of animal, and 2) when administered by various routes either in the same or different species. It is hoped that, if the data are marshaled in this manner, they will support definite inferences as to 1) whether results of a test for carcinogenicity in one species would predict with accuracy the carcinogenicity of the material for another species, and 2) whether results by one route of administration would predict the carcinogenicity of the material if given by another route.

An attempt is also being made to establish whether there is a graded dosage response to carcinogens in general as there is to other toxicants, and, if so, whether the relationship forms a good basis for establishing a "safe" level of usage for man from a "no-effect" level in test animals.

The Subcommittee has not yet come to definite conclusions on any of these questions. It realizes, however, that no matter what conclusions are reached, it will still be necessary, as a practical matter, for judgments to be made as to the carcinogenic hazard attending the use of food additives. It is, therefore, assembling information on methods used by various laboratories to detect carcinogenicity and reviewing information on the rationale of such methods with a view to proposing some general requirements of tests for carcinogenicity and general principles for estimating the carcinogenic hazard from the use of food additives.

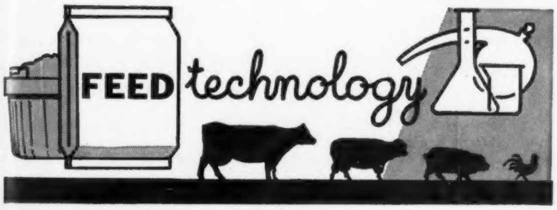
The major current activity of the Subcommittee on Food Technology is the revision of the FPC publication, "The use of chemical additives in food processing." This is being carried out with the aid of trade associations and individual industry representatives.

The Subcommittee on Toxicology is revising the FPC statement, "Principles and procedures for evaluating the safety of intentional chemical additives in foods." It is also compiling information on the safety of the glycerides of lauric acid.

The Committee continues to be supported by grants from industrial concerns, commercial laboratories, and consultants. Grants from 143 such organizations and individuals were received in 1958. Representatives of the granting organizations, trade associations, scientific and technical societies, and government agencies make up a Liaison Panel. The Committee obtains much help through consultation, receipt of information, and encouragement from the Panel.

A matter under consideration is that the FPC might be useful in preparing a pharmacopoeia — a compilation analogous to that of the U. S. Pharmacopoeia. An *ad hoc* committee has been appointed to consider whether this is desirable; Dr. J. R. Mahoney of Merck & Co., Inc., is chairman.

W. F. GEDDES



FEED MICROSCOPISTS' MEETING

Of interest to all feed chemists was the program at the recent 7th annual meeting of the American Association of Feed Microscopists held in Quincy, Illinois, April 27–29. About two dozen technical papers and laboratory demonstrations were presented during the three-day period. Several of these are listed below:

Dispersion staining, an aid to the microscopic inspection of feeds, by G. D. Miller, Kansas State University

Histology and photomicrography applied to soybean products, by T. G. Campbell, Central Soya Company

Microchemical tests for trace minerals in feeds, by Miss E. M. Gordon, Canada Department of Agriculture

Systematic microscopic identification of ingredients in mixed fertilizers, C. T. Smith, University of Massachusetts

Quantitative estimation of ingredients in feeds, by E. E. Brown, Texas Agricultural Experiment Station

Effect of overheating on nutritional value of protein, by A. J. Gehrt, Moorman Manufacturing Company

It is impossible to list all the presentations here, or to adequately summarize the extensive and practical information provided. Complete copies of each paper will appear in the *Proceedings* of the meeting, now in preparation. Chemists in feed and fertilizer industries, and in state, government, and industrial laboratories, will want to obtain copies. These will be available soon, at nominal cost, through G. M. Barnhart, secretary-treasurer, American Association of Feed Microscopists, c/o Missouri Department of Agriculture, Jefferson City, Mo.

R. C. WORNICK

NUTRITION

CALCIUM OXALATE EXCRETION AND VITAMIN B_6 DEFICIENCY

Recent observation on the effect of vitamin B_6 deficiency indicate that the loss of this vitamin due to the processing of cereal products may assume an importance equal to the losses of thiamine, riboflavin, niacin, and iron. For this reason, millers and bakers will follow with interest future studies of this vitamin, which heretofore has been given little consideration. Future research could conceivably lead to revision of enrichment mixtures to include synthetic vitamin B_6, which is available at reasonable cost.

Calhoun *et al.* (Calhoun, W. K., Jennings, R. B., and Bradley, W. B. Calcium oxalate excretion and hematuria in vitamin B_6-deficient rats fed phthalylsulfathiazole. *J. Nutrition 67:*237; 1959) observed abnormally large quantities of calcium oxalate crystals in the urine of rats fed vitamin B_6-deficient diet. The addition to the diet of a level of vitamin B_6 known to be adequate for normal growth did not completely eliminate the oxalate excretion. However, somewhat higher levels of vitamin B_6 decreased the excretion of calcium oxalate to the extent that it could not be detected microscopically. These authors determined that the oxaluria of vitamin B_6-deficient rats is caused by defective metabolism of glycine, an amino acid which is a component of dietary proteins. Examination of the urinary tracts of animals fed the vitamin B_6-deficient diet for relatively short periods of time revealed severe kidney damage, deposition of crystalline material in the kidney tissues, and urinary calculi (stones which partially block the urinary tract).

Gershoff *et al.* (Gershoff, S. N., and Faragalla, F. F. Endogenous oxalate synthesis and vitamin B_6 deficiency in the rat. *Federation Proc. 18:* 526; 1959) have reported findings which confirm these observations. These investigators induced a more severe vitamin B_6 deficiency by feeding the pyridoxine analog, deoxypyridoxine. Also, they maintained their experimental animals for a longer period of time, with the result that kidney damage and kidney stone formation were more severe.

The excretion of abnormal quantities of oxalic acid by humans is not rare. It may be revealed only after sufficient calcium oxalate crystals have been retained in the urinary tract to produce stones which interfere with urinary flow. Surgery is frequently required for the removal of kidney stones and, in some cases, these stones result in loss of function of one or both kidneys.

These observations concerning pyridoxine deficiency, oxaluria, and kidney stone production in rats do not prove, but only suggest, the possibility that a vitamin B_6 deficiency may contribute to the production of kidney stones in humans. However, Gershoff *et al.* (Gershoff, S. N., Mayer, Agnes, and Kulczyki, L. L. The effect of pryidoxine administration on the urinary excretion of oxalic acid, pyridoxine, and related compounds in mongoloids and non-mongoloids. *J. Clinical Nutrition 7:*76; 1959) have provided some evidence that the pyridoxine-oxaluria relationship observed in experimental animals exists in humans. They have determined that the administration of large doses of pyridoxine to individuals who were maintained on a presumably adequate diet reduced the level of urinary oxalic acid below that considered to be normal. If future research should reveal that kidney stones in man are caused by vitamin B_6 deficiency, an important role of pyridoxine in human nutrition will be revealed and, undoubtedly, effort will be made to assure adequate distribution of this vitamin.

W. B. BRADLEY

AACC LOCAL SECTIONS

Pacific Northwest Section members are holding their annual meeting on Monday and Tuesday, June 22 and 23, at the Benjamin Franklin Hotel, Seattle. The program will be reported more fully later. The planned entertainment is sure to attract a full complement of members and their wives and children: a boat trip on Puget Sound with a salmon barbecue at Kiana Lodge; bowling, the annual banquet, and the special ladies' luncheon. Don Sundberg is local arrangements chairman.

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Northern California Section met on June 4 for cocktails and ham dinner in the Redwood Room, Leopard Restaurant, in San Francisco. The program was given over to reports on the national AACC convention in Washington, D.C., in May – business, technical, and milling and baking technology – by members who attended. Nomination of officers for 1959-60 was held.

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Kansas City Section met on June 17 at Hotel President, for informal dinner at 6:30 and formal meeting at 8:00 p.m. A panel discussion on test baking and bakery service problems was stimulating, and brought out useful points of information. Taking part were Jim Bennett and Larry Marnett, C. J. Patterson Co.; Jim Doty and Vernon Stiles, Doty Laboratories; Bill Green, Continental Baking Co.; and Glenn Hargrave, The Paniplus Co.

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Niagara Frontier Section had its annual fun-and-eats festival, a chicken barbecue, on June 20, again at the country home of Ann Collins. Members and their families, children included, enjoyed a day of play in the grounds and swimming pool. General chairman Bob Van Burek turned duties over to a big committee, one person responsible for each item of food, from Stan Skelskie who turned out the barbecued chicken, through Sue Kazanjan (cabbage salad), Virginia Davis (beans), Jule Schneider (scalloped potatoes), Mary Van Burek (potato salad), Jerry Mruk (rolls), Jack Monier (cakes); and Norm Schack, ice cream. Donations were received by Al Camp. Bill Davis took care of coffee and milk; Bill Kazanjan, beer; Mel Shero, pop; and Maxcy Lynch saw to the ice. Games and prizes needed more than one person's attention: Lee and Orrin Wolff were assisted by Vince Lawson with those for the children, and Bill Smith, with Clayt Sander, were in charge of those for adults.

Bob Segmen had a roving commission with the camera. Chet ("Prophet") Bald was entrusted with the important item of the weather, and Chuck Bronold handled the finances for the much-enjoyed affair.

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PREVIEWS *from* CEREAL CHEMISTRY

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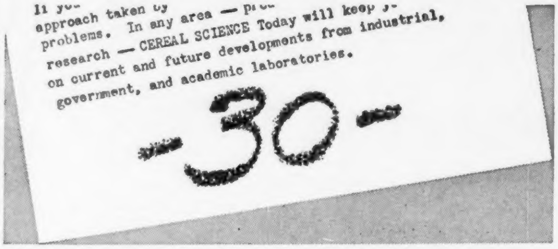

BEFORE AND AFTER

Not too many of us have the opportunity to see ourselves in movies, especially those taken some twenty-five years ago. However, there is a select group among AACC members who attended the 1931 Annual Meeting in Louisville, Kentucky, and were lucky enough to be spotted by Leslie R. Olsen and his roving camera. Mr. Olsen was one of the pioneers in the now popular hobby of home movies and used his talents at many AACC meetings, both local and national. As a long time member of the Northwest Section in Minnesota, Olsen shot a lot of film around Minneapolis. Just this spring the Northwest Section had an opportunity to view some footage taken in the late thirties and early forties of their meetings and outdoor social gatherings.

Leslie Olsen is now retired and lives in California. Through his co-operation and loan of about 800 ft. of film, the St. Paul office was able to have a duplicate made and this was the film shown in Minneapolis and in Washington, D.C., at our Annual Meeting. Olsen has also given the AACC many individual and group pictures of AACC members taken as early as 1917. He presented these along with a complete file of AACC News Letters (predecessor to CEREAL NEWS and CEREAL SCIENCE TODAY) to the AACC at our San Francisco Meeting in 1957.

Our thanks and deep appreciation go to Mr. Olsen, an early president of the Association, whose generosity has provided the archives with some valuable additions.

For those of you who may wish to extend greetings to Mr. Olsen, his address is: 816 Patio Drive, Campbell, California.

WE HAD HOPED . . .

. . . To run another group of candids taken at the recent Washington meeting in this issue, but space was just not available. We have so many excellent papers awaiting publication that our original plans will have to be modified. However, we will try to squeeze two or three into each of the next two issues.

MOVING DAY

After some three years of thinking about it, talking about it, and finally planning it, the AACC has moved its headquarters off the St. Paul Campus of the University of Minnesota. Our new address (and please take note) is 1955 University Avenue, St. Paul 4.

We naturally miss our old friends and associates who have been watching AACC activities for the past 15 years, but lack of space was pulling our efficiency down. What started out as adequate space for one secretary working strictly on CEREAL CHEMISTRY ended up by trying to serve two full-time employees, two part-time employees and the business load of CEREAL CHEMISTRY, CEREAL SCIENCE TODAY, and the Association. Storage space for back issues, books (*Monograph Series* and *Cereal Laboratory Methods*), supplies and vital business records was almost nonexistent.

At last we have a place for everything (although not everything is in place just yet!) and we will be able to offer you a chair if you should happen to visit us. And please don't forget to drop in for a chat if you're in the Twin Cities and have the time. We're centrally located between the two towns on the main drag, University Avenue. The next time you're in St. Paul or Minneapolis why not stop in and see *your* Association's headquarters!

R.J.T.